# Draft Environmental Impact Statement for the Montanore Project

## Volume I

**Summary**

**Chapter 1: Purpose and Need**

**Chapter 2: Alternatives, Including Proposed Action**

**Chapter 3: Affected Environment and Environmental Consequences, through Section 3.9, Geotechnical**

*Cabinet Mountains* *Photo by M. Holdeman*

United States Department of Agriculture
Forest Service
Northern Region

**Kootenai National Forest**

**Montana Department of Environmental Quality**

# Environmental Impact Statement For The Montanore Project

## Kootenai National Forest
## Lincoln County, MT

**Lead Agencies:** USDA Forest Service, Kootenai National Forest
Montana Department of Environmental Quality

**Cooperating Agencies:** U.S. Army Corps of Engineers
Bonneville Power Administration
Lincoln County, Montana


**Responsible Officials:**

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Libby MT, 59923-3022

Richard Opper
Montana DEQ
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Helena, MT 59620-0901

**For Information Contact:**

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406-283-7525

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**Abstract:** The Montanore Project Draft Environmental Impact Statement (Draft EIS) describes the land, people, and resources potentially affected by Montanore Minerals Corporation's (MMC) proposed copper and silver mine (Montanore Project). As proposed, the project would consist of eight primary components: the use of an existing evaluation adit, an underground mine, a mill, three additional adits and portals, a tailings impoundment, access roads, a transmission line, and a rail loadout. Three mine alternatives and a No Action Alternative (No Mine) and four transmission line alternatives, plus a No Action Alternative (no transmission line), are analyzed in detail.

The Kootenai National Forest (KNF) and U.S. Army Corps of Engineers (Corps) will use this information to determine whether to issue approvals necessary for construction and operation of the Montanore Project. The KNF's preferred mine alternative is Alternative 4, Agency Mitigated Little Cherry Creek Impoundment Alternative, provided it could be permitted by the Corps. The mine is currently covered by an existing state operating permit. Therefore, the Montana Department of Environmental Quality (DEQ) did not identify a preferred mine alternative. The DEQ will use this information to determine whether to revise the existing state operating permit for the mine and to authorize construction of the transmission line. DEQ selected Alternative D, Miller Creek Transmission Line Alternative as the preferred transmission line alternative. Public acceptance of a transmission line is one criterion used to locate a transmission line. Thus, identification of Alternative D is tentative, pending public comment. The Bonneville Power Administration will use the information to decide whether to build a new substation and loop line, and to provide power to its customer, Flathead Electric Cooperative, which would provide power to the mine.


Reviewers should provide the KNF and the DEQ with their comments during the review period of the Draft EIS. This will enable the KNF and the DEQ to analyze and respond to the comments at one time and to use the information acquired in the preparation of the final environmental impact statement (Final EIS), thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act (NEPA) and Montana Environmental Policy Act (MEPA) process so that it is meaningful and alerts the agency to the reviewers' position and contentions [Vermont Yankee Nuclear Power Corp. v. Natural Resource Defense Council, 435 U.S. 519, 553 (1978)]. Environmental objections that could have been raised at the Draft EIS stage may be waived if not raised until after completion of the Final EIS. [City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980)]. Comments on the Draft EIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 Code of Federal Regulations (CFR) 1503.3).

**Send Comments to:** Bobbie Lacklen
Kootenai National Forest
31374 U.S. 2 West
Libby MT 59923-3022

**Date Comments Must Be Received:** May 28, 2009

# Montanore Project EIS

## U P D A T E

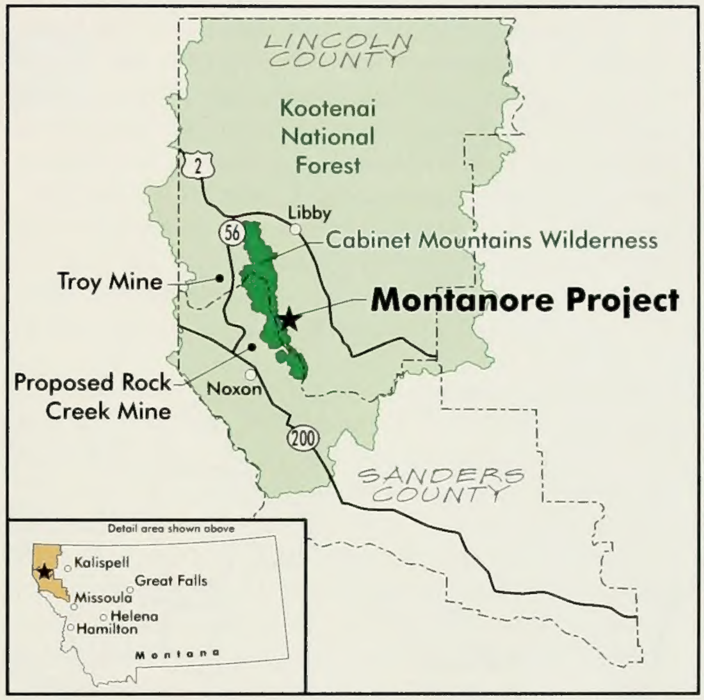
Montana Department of Environmental Quality

**February 2009**

### Public Comment Requested

The Kootenai National Forest and the Montana Department of Environmental Quality issued a Draft Environmental Impact Statement (EIS) on February 27, 2009 disclosing the environmental impacts of the Montanore Project, a proposed silver/copper mine and associated electric transmission line. The agencies will hold an open house and public hearing to solicit comments on the Draft EIS in Libby on April 16, 2009 in the Ponderosa Room at City Hall in Libby, MT. All comments on the Draft EIS must be received by May 28, 2009.

After the comment period closes on May 28, 2009, the agencies will carefully consider each submitted comment. Comments will be used in preparing a Final EIS for the proposed project. Based on the nature of the comments, alternatives may be revised, or the effects analysis may be adjusted. Responses to substantive comments will be included in the Final EIS. The agencies will make the necessary decisions on the proposed project after the Final EIS is issued. Each agency's decision will be documented in a Record of Decision or similar decision-making document.



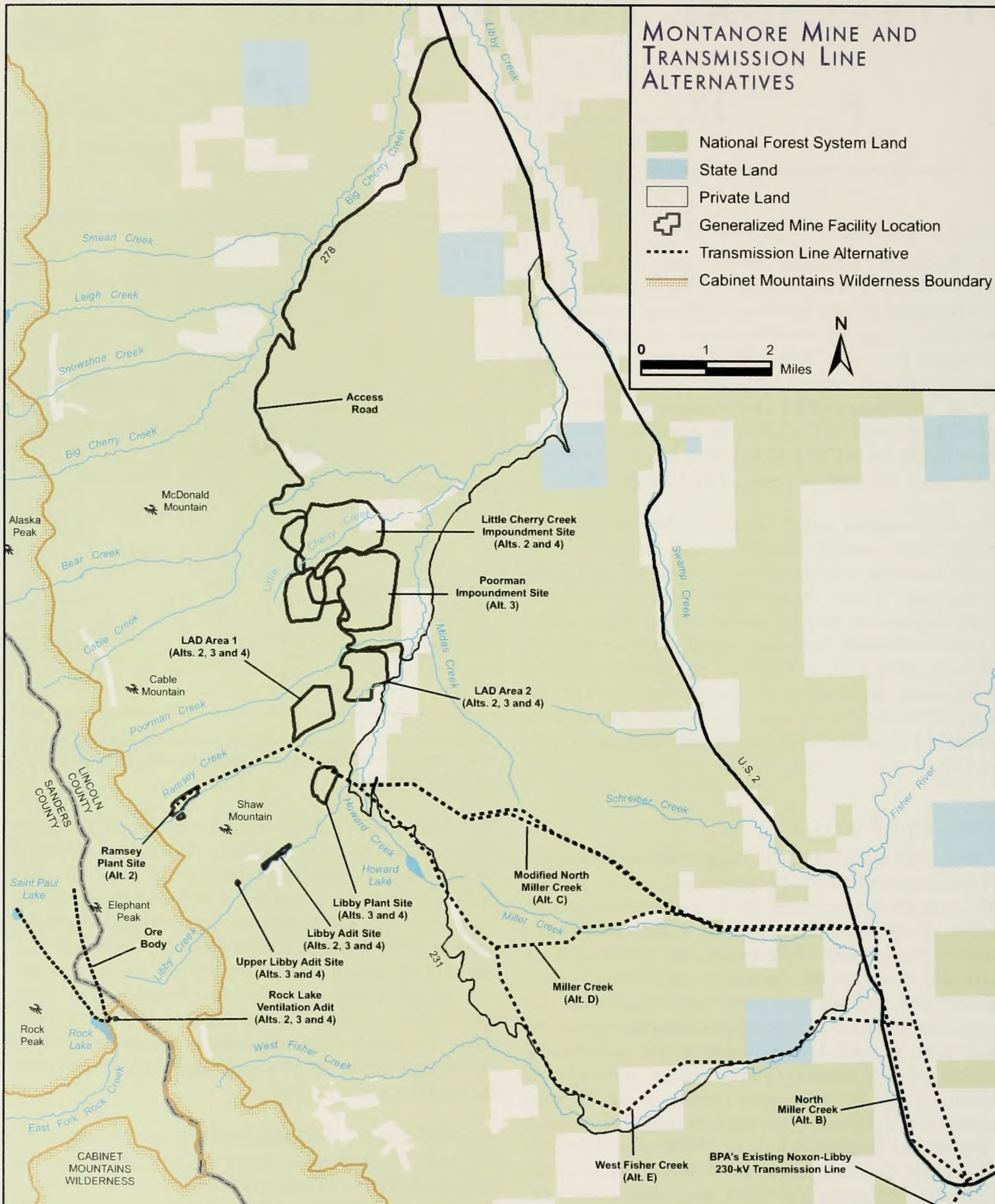

*The underground mine would be in Sanders County. The mill and other facilities would be in Lincoln County, 18 miles south of Libby, Montana.*

### Proposed Project

In 2005, Mines Management, Inc. (MMI), an Idaho corporation, submitted a Plan of Operations and an application for an Operating Permit for the proposed Montanore Project to the Kootenai National Forest (KNF) and Montana Department of Environmental Quality (DEQ). MMI also submitted an application for a 230-kV transmission line, and air and water quality permits. The Montanore Project is a proposed underground copper and silver mine in northwestern Montana. The underground mine would be in Sanders County, and the mill and other facilities would be in Lincoln County, about 18 miles south of Libby, Montana (see regional map).The ore body is beneath the Cabinet Mountains Wilderness. All access and surface facilities would be located outside of the wilderness. Montanore Minerals Corp. (MMC), a wholly-owned subsidiary of Mines Management, Inc., would be the project operator.

The Montanore Project was originally permitted by Noranda Minerals Corporation (Noranda) in the early 1990s. Many of Noranda's permits for the Montanore Project terminated or expired. Noranda relinquished the Forest Service's authorization to construct and operate the mine in 1992. Noranda's DEQ Operating Permit #00150 and MPDES permit were not terminated because reclamation of the Libby Adit was not completed. In 2006, Newhi, Inc., a subsidiary of MMI, acquired Noranda. MMC (formerly Noranda) remains the holder of DEQ Operating Permit #00150 and the existing MPDES permit for the Montanore Project.

The KNF and the DEQ are joint lead agencies on an EIS for MMC's proposal. Cooperating agencies are the Bonneville Power Administration (BPA), Army Corps of Engineers, and Lincoln County, Montana. A single Draft EIS for the Montanore Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. Before construction and oper-



Montanore Mine and Transmission Line Alternatives
National Forest System Land
State Land
Private Land
Generalized Mine Facility Location
Transmission Line Alternative
Cabinet Mountains Wilderness Boundary
N
0
1
2
Miles
Libby Creek
Big Cherry Creek
278
Smearl Creek
Leigh Creek
Snowshoe Creek
Access Road
Big Cherry Creek
McDonald Mountain
Alaska Peak
Bear Creek
Little Cherry Creek
Little Cherry Creek Impoundment Site (Alts. 2 and 4)
Poorman Impoundment Site (Alt. 3)
Cable Creek
LAD Area 1 (Alts. 2, 3 and 4)
Cable Mountain
Poorman Creek
Midas Creek
LAD Area 2 (Alts. 2, 3 and 4)
Swamp Creek
U.S. 2
Ramsey Creek
Lincoln County
Sanders County
Shaw Mountain
Howard Creek
Schreiber Creek
Fisher River
Ramsey Plant Site (Alt. 2)
Howard Lake
Modified North Miller Creek (Alt. C)
Saint Paul Lake
Elephant Peak
Libby Plant Site (Alts. 3 and 4)
Miller Creek
Ore Body
Libby Adit Site (Alts. 2, 3 and 4)
Libby Creek
231
Upper Libby Adit Site (Alts. 3 and 4)
Miller Creek (Alt. D)
Rock Lake Ventilation Adit (Alts. 2, 3 and 4)
Rock Peak
Rock Lake
West Fisher Creek
Rock Creek
East Fork Rock Creek
North Miller Creek (Alt. B)
Cabinet Mountains Wilderness
West Fisher Creek (Alt. E)
BPA's Existing Noxon-Libby 230-kV Transmission Line

ation of the proposed project could begin, various other permits, licenses, or approvals from the two lead agencies and other agencies would be required.

With minor exceptions, MMC proposes to construct, operate, and reclaim a new mine and transmission line in accordance with the terms and conditions of the DEQ's Operating Permit #00150 and other agencies' permits and approvals issued to Noranda in 1992 and 1993. MMC and MMI have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC to modify DEQ Operating Permit #00150. The KNF considers MMC's 2005 Plan of Operations a new mining proposal on National Forest System lands.

As proposed by MMC, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 mile east of the Cabinet Mountains Wilderness boundary. An additional adit would be located on private land in the Libby Creek drainage, and a raise or vertical opening would be built for ventilation on MMC's two patented mining claims adjacent to Rock Lake. A tailings impoundment is proposed in the Little Cherry Creek drainage, and would require the diversion of Little Cherry Creek. Two land application disposal (LAD) areas are proposed to allow for discharge of water. Waste rock would be stored temporarily at one LAD area. MMC would upgrade National Forest System road #278 (Bear Creek Road), NFS road #4781 (Ramsey Creek Road), and NFS road #2316 (Upper Libby Creek Road). The operating permit area would be 3,628 acres and the disturbance area would be 2,582 acres.

A new, 230-kilovolt (kV) electric transmission line would provide power to the mill and other mine facilities. A new substation also would be needed. BPA's proposed substation site at the Noxon-Libby 230-kV transmission line is in an area known locally as Sedlak Park, about 30 miles southeast of Libby on U.S. 2. The BPA would design, construct, own, operate, and maintain the Sedlak Park Substation and loop line. The BPA is prohibited by law from providing power directly to a user. Flathead Electrical Cooperative would be the retailer of power to the mine project. MMC would be responsible for funding construction of the powerline, substation, and loop line that would connect the substation to BPA's Noxon-Libby 230-kV transmission line.

MMC's proposed transmission line alignment would head northwest from the substation for about 1 mile paralleling U.S. 2, and then follow the Fisher River and U.S. 2 north about 3.3 miles. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then turn northwest and traverse up a tributary to Miller Creek. The alignment would then cross into the upper Midas Creek drainage, and then down to Howard and Libby Creek drainages. The alignment would cross the low ridge between Libby Creek and Ramsey Creek, and then would generally follow Ramsey Creek to the Ramsey Plant Site. All structures would be steel monopoles. Helicopter use for vegetation clearing and structure placement would be at MMC's discretion.

## Mine Alternatives

The agencies developed alternatives to MMC's proposal based on various regulatory requirements. Besides the No Action and a Proposed Action alternatives for both the mine facilities and transmission line, the lead agencies analyzed in detail two mine alternatives and three transmission line alternatives. Mine alternatives are numbered (Alternatives 1 through 4) and transmission line alternatives have letters (Alternatives A through E). Alternatives 1 and A are the No Action alternatives. Alternative 2 is MMC's proposed mine alternative and Alternative B is MMC's proposed transmission line alternative.

***No Action.*** In the No Action alternatives, MMC would not develop the Montanore Project, although it is approved under DEQ Operating Permit #00150. The Montanore Project, as proposed, cannot be implemented without a corresponding Forest Service approval of a Plan of Operations. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. MMC also would not build a 230-kV transmission line to provide power. The BPA would not tap the Noxon-Libby 230-kV transmission line nor would it build the Sedlak Park Substation.

***Mine Alternative 3.*** Mine Alternative 3 would incorporate modifications and mitigating measures proposed by the lead agencies to reduce or eliminate adverse environmental impacts. These measures are in addition to or instead of the mitigations proposed by MMC. In Alternative 3, the four major mine facilities would be located in alternative locations. MMC would develop a Poorman Tailings Impoundment Site north of Poorman Creek for tailings disposal, use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed operating permit and disturbance areas at LAD Areas 1 and 2 to avoid important resources. The operating permit area would be 2,606 acres and the disturbance area would be 2,011 acres. Mine alternatives 3 and 4 include additional mitigation and monitoring not proposed by MMC.

***Mine Alternative 4.*** In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed permit and disturbance areas at the LAD Areas, as in Alternative 3. MMC would modify the proposed Little Cherry Creek Tailings Impoundment Site operating permit and disturbance areas to avoid riparian areas and old growth in the Little Cherry Creek drainage. Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint, and to minimize disturbance of riparian areas, core grizzly bear habitat, and old growth. At closure, surface water runoff from the impoundment surface would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The operating permit area would be 3,245 acres and the disturbance area would be 2,254 acres.

## Transmission Line Alternatives

***Transmission Line Alternative C.*** The primary modification in Alternative C to MMC's proposed North Miller Creek alignment (Alternative B) would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River. Other modifications to the alignment are relatively small shifts along Miller Creek and an unnamed tributary to Miller Creek. Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used in Alternatives C, D and E. In some locations in Alternatives C, D and E, a helicopter would be used for vegetation clearing and structure construction.

***Transmission Line Alternative D.*** As in Alternative C, this alternative modifies MMC's proposed North Miller Creek alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. The alignment would following Miller Creek and then go north in the Howard Creek drainage to the Libby Plant Site. This alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area.

***Transmission Line Alternative E.*** The primary difference between Alternative E and Alternative B is routing the line on the north side of West Fisher Creek and not up the Miller Creek drainage to minimize effects on core grizzly bear habitat. Alternative E would use the same alignment north of the Sedlak Park Substation as Alternatives C and D, cross the Fisher River and West Fisher Creek south of the confluence of the river and the creek. It would be north of West Fisher Creek for about 6 miles. As in Alternative D, this alternative would use an alignment about 0.5 mile east of Howard Lake.

## Additional Information

The Draft EIS and the Draft EIS Summary are available for download from the Kootenai National Forest website at:

*www.fs.fed.us/r1/kootenai/projects/projects/montanore/index.shtml*

or from the DEQ's website at:

*http://www.deq.mt.gov/eis.asp*

## Open House and Public Meeting April 16, 2009

*The agencies will hold an open house and public hearing to solicit comments on the Draft EIS in Libby on* ***April 16, 2009****. The open house will start at 5:00 p.m. in the Ponderosa Room at Libby City Hall 952 East Spruct Street, Libby, MT. Resource specialists will be available to discuss the project and the Draft EIS analysis. The hearing will start at 6:30 p.m. with the solicitation of oral comment. All comments on the Draft EIS must be received by* ***May 28, 2009.***

*Comments should be submitted to:*

**Bobbie Lacklen**
Kootenai National Forest
Supervisor's Office
31374 U.S. Highway 2
Libby, Montana 59923
Phone (406) 283-7681
Email: r1_montanore@fs.fed.us

**Bonnie Lovelace**
Dept. of Environmental Quality
P.O. Box 200901
Helena, Montana 59620
Phone (406) 444-1760
Email: DEQMontanoreEIS@mt.gov

USDA United States Department of Agriculture | Forest Service | Kootenai National Forest | 31374 US Highway 2 Libby, MT 59923

Montana Department of Environmental Quality | PO Box 200901 Helena, MT 59620-0901

File Code: 1950
February 25, 2009

Dear Interested Party,

The Kootenai National Forest (KNF) and the Montana Department of Environmental Quality (DEQ) have completed the Montanore Project Draft Environmental Impact Statement (Draft EIS). The Montanore Project is a proposed copper and silver underground mine located about 18 miles south of Libby near the Cabinet Mountains of northwestern Montana. Either a Summary or the full Draft EIS is enclosed for your review and comment. Three mine alternatives and a No Action Alternative (No Mine) and four transmission line alternatives and a No Action Alternative (no transmission line) are analyzed in detail.

The KNF and U.S. Army Corps of Engineers (Corps) will use this information to determine whether to issue approvals necessary for construction and operation of the Montanore Project. The KNF's preferred mine alternative is Alternative 4, Agency Mitigated Little Cherry Creek Impoundment Alternative, provided it could be permitted by the Corps. The mine is currently covered by an existing state operating permit. Therefore, the DEQ did not identify a preferred mine alternative. The DEQ will use this information to determine whether to revise the existing state operating permit for the mine and to authorize construction of the transmission line. The DEQ selected Alternative D, Miller Creek Transmission Line Alternative as the preferred transmission line alternative. Public acceptance of a transmission line is one criterion used to locate a transmission line. Thus, identification of Alternative D is tentative, pending public comment. The Bonneville Power Administration will use the information to decide whether to build a new substation and loop line, and to provide power to its customer, Flathead Electric Cooperative, which would provide power to the mine.

Your comments will be invaluable to the agencies as they prepare the Final EIS and Record of Decision. Comments must be postmarked or received 90 days from the date the Notice of Availability of the DEIS is published in the Federal Register. The Notice of Availability will be published on February 27, 2009 and the 90-day comment period will end on May 28, 2009.

Written comment can be submitted to Bobbie Lacklen, Kootenai National Forest, 31374 U.S. 2 West, Libby, MT 59923-3022, or by email to: r1_montanore@fs.fed.us, or to DEQ at: deqmontanoreEIS@mt.gov. Comments can also be faxed to (406) 283-7709, or hand-delivered to either the KNF or the DEQ between the hours of 8:00 a.m. and 4:30 p.m.

As outlined in 36 CFR 215.13, only those who submit timely comments will be accepted by the Forest Service as appellants following the release of the Montanore Project Final EIS and Record of Decision. Comments must be specific to the proposed activities and area being analyzed. Comments should include: (1) name, address, telephone number, and organization represented, if any; (2) title of the document on which the comment is being submitted; (3) specific facts and supporting reasons for the Responsible Official to consider; and (4) signatures.

All comments become part of the public record associated with this project, and are available for public review, along with the name(s) of the commenter(s). Comments submitted anonymously will be accepted and considered; however, those who submit anonymous comments will not have standing to appeal the subsequent decision under 36 CFR 215.12.

Thank you for taking time to be involved with the Montanore Project. For more information or to request a copy of the Draft EIS, please contact one of the Project Coordinators, Bobbie Lacklen, 406-283-7681, or Bonnie Lovelace, MT DEQ, PO Box 200901, Helena MT 59620, by phone at 406-444-1760 or by email at blovelace2@mt.gov.

Sincerely,

Carrie Winslow
for PAUL BRADFORD
Forest Supervisor

Richard H. Opper
RICHARD H. OPPER
Director, DEQ

enclosure

# Summary

## Purpose and Need for Action

## Background

This document presents a summary of the Draft Environmental Impact Statement (Draft EIS) for the proposed Montanore Project. As a summary, it cannot provide all of the detailed information contained in the Draft EIS. If more detailed information is desired, please refer to the Draft EIS and the referenced reports. For any remaining questions or concerns, contact the individuals listed in the last section of this summary, *Where to Obtain More Information.*

The U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF), and the Montana Department of Environmental Quality (DEQ) have prepared the Draft EIS in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA). These laws require that if any action taken by the DEQ or the KNF may "significantly affect the quality of the human environment," an environmental impact statement must be prepared. This Draft EIS also has been prepared in compliance with the USDA NEPA policies and procedures (7 Code of Federal Regulations (CFR) part 1b), the Forest Service's Environmental Policy and Procedures Handbook (Forest Service Handbook 1909.15), DEQ's MEPA regulations (Administrative Rules of Montana (ARM) 17.4.601 *et seq.*), and the U.S. Army Corps of Engineers' (Corps) NEPA implementation procedures for its regulatory program (Appendix B of 33 CFR 325). Two "lead" agencies have been designated for this project: the KNF and the DEQ. Cooperating agencies are the Bonneville Power Administration (BPA), Corps, and Lincoln County, Montana. A single Draft EIS for the Montanore Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. Before construction and operation of the proposed project could begin, various other permits, licenses, or approvals from the two lead agencies and other agencies would be required.

The Proposed Action, the Montanore Project, is a proposed copper and silver underground mine and associated transmission line located about 18 miles south of Libby near the Cabinet Mountains of northwestern Montana. The ore body is beneath the Cabinet Mountains Wilderness (CMW). All access and surface facilities would be located outside of the CMW boundary. Montanore Minerals Corp. (MMC), a wholly owned subsidiary of Mines Management, Inc. (MMI), would be the project operator.

The discovery of mineral deposits for the Montanore Project dates back to the early 1980s. In 1980, Heidelberg Silver Mining Company (Heidelberg) located certain mining claims in sections 29 and 30 of Township 27 North, Range 31 West, M.M., Sanders County, Montana. Subsequently, in 1983, Pacific Coast Mines, Inc. (Pacific), a subsidiary of U.S. Borax and Chemical Corporation (Borax), located other mining claims in sections 29 and 30 of Township 27 North, Range 31 West, M.M., Sanders County, Montana. The mining claims located by Pacific in 1983 included the lode mining claims Hayes Ridge (HR) 133 and HR 134 adjacent to Rock Lake. (These claims are shown on Figure 11 in the EIS.) This outcrop contained stratabound copper-silver mineralization, extending over a 200-foot vertical thickness.

In 1984, Pacific leased Heidelberg's mining claims pursuant to the terms of a 1984 Lease and Option to Purchase Agreement (Lease Agreement). Subsequently, in 1988, Heidelberg was merged into Newhi, Inc. (Newhi), a subsidiary of Mines Management, Inc. (MMI). As a result of that merger, Newhi became the successor in interest to Heidelberg under the Lease Agreement. Also in 1988, Pacific assigned its interest in HR 133 and HR 134 and its interest in the Lease Agreement to Noranda Minerals Corporation (Noranda), a subsidiary of Noranda Finance Inc. (Noranda Finance).

In 2002, Noranda terminated the Lease Agreement with Newhi. Pursuant to the terms of that agreement, Noranda conveyed its interest in HR 133 and HR 134 to Newhi. In 2006, Newhi acquired all of the issued and outstanding shares of Noranda. Immediately following the acquisition of Noranda, Noranda's name was changed to Montanore Minerals Corporation (MMC).

The permitting process for the Montanore Project began in 1989. In that year, Noranda obtained an exploration license from the Montana Department of State Lands (DSL) and other associated permits for construction of an exploration adit from private land in upper Libby Creek. Soon after obtaining the exploration license, Noranda began excavating the Libby Adit. Noranda also submitted a "Petition for Change in Quality of Ambient Waters" (Petition) to the Board of Health and Environmental Sciences (BHES) requesting an increase in the concentration of select constituents in surface and ground water above ambient water quality, as required by Montana's 1971 nondegradation statute. After constructing about 14,000 feet of the Libby Adit, Noranda ceased construction in 1991 in response to elevated nitrate concentration in surface water and low metal prices.

Although construction ceased in 1991, the permitting process continued. Specifically, the KNF, the Montana Department of Health and Environmental Sciences (DHES), the Montana Department of Natural Resources and Conservation (DNRC), and the DSL, DEQ's predecessor agency, prepared a Draft, Supplemental Draft, and Final EIS on the proposed project. The environmental review process culminated in 1992 with BHES's issuance of an Order approving Noranda's Petition (BHES 1992) and the DSL's issuance of a Record of Decision (ROD) and Hard Rock Operating Permit #00150 (DSL 1992) to Noranda. In 1993, the KNF issued its ROD (KNF 1993), the DNRC issued a Certificate of Environmental Compatibility and Public Need under MFSA (DNRC 1993), and the U.S. Army Corps of Engineers issued a 404 permit (Corps 1993). These decisions selected mine and transmission line alternatives that allowed for the construction, operation, and reclamation of the project.

The BHES Order, issued to Noranda in 1992, authorized degradation and established nondegradation limits in surface and ground water adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established numeric nondegradation limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface and ground water), as well as nitrate (ground water only), and total inorganic nitrogen (surface water only). Pursuant to BHES's Order, these nondegradation limits apply to all surface and ground water affected by the Montanore Project and remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992). The Order also adopted the modification developed in Alternative 3, Option C, of the Final EIS, addressing surface and ground water monitoring, fish tissue analysis, and in-stream biological monitoring. The Order is presented in Appendix A in the EIS.

In 1997, a Montana Pollutant Discharge Elimination System (MPDES) permit was issued to Noranda by the DEQ (MT-0030279) to allow discharges of water flowing from the Libby Adit to Libby Creek. Three outfalls were included in the permit: Outfall 001 – percolation pond; Outfall 002 – infiltration system of buried pipes; and Outfall 003 – pipeline outlet to Libby Creek. Surface discharge from the adit ceased in 1998 and water in the adit flowed to the underlying ground water.

Apart from the permitting process, Noranda filed an application for patent with the Bureau of Land Management (BLM) in 1991 for lode claims HR 133 and HR 134 (Patent Application MTM 80435). In 1993, a Mining Claim Validity Report was issued by BLM recommending that BLM issue patent to Noranda for HR 133 and HR 134. In 2001, a patent was issued to Noranda for the portion of HR 134 that lies outside the CMW (Patent Number 25-2001-0140) and a separate patent was issued to Noranda for the mineral deposits for HR 133 and the portion of HR 134 that lies inside the CMW (Patent Number 25-2001-0141).

As discussed above, Noranda conveyed its interests in lode claims HR 133 and HR 134 to Newhi in 2002. By that time, many of Noranda's permits for the Montanore Project terminated or expired, such as DEQ's air quality permit, the Corps' 404 permit, KNF's approval, and the State's certification of the transmission line. In 2002, Noranda notified the KNF it was relinquishing the authorization to operate and construct the Montanore Project. Noranda's DEQ Operating Permit #00150 and MPDES permit were not terminated because reclamation of the Libby Adit was not completed.

## Proposed Action

In 2005, MMI submitted an application for a hard rock operating permit to the DEQ and a proposed Plan of Operations for the proposed Montanore Project to the KNF. MMI also submitted to the DEQ an application for a 230-kV transmission line certificate of compliance, an application for an air quality permit, and an application for a MPDES permit that covered additional discharges not currently permitted under the existing MPDES permit for the Libby Adit.

In 2006, Newhi acquired all of the issued and outstanding shares of Noranda pursuant to the terms of a Stock Transfer Agreement between Noranda Finance, Newhi, and MMI. Although the name of Noranda was changed to Montanore Minerals Corporation (MMC) immediately following Newhi's acquisition of Noranda's shares, MMC (formerly Noranda) remains the holder of DEQ Operating Permit #00150 and the MPDES permit for the Montanore Project.

MMI and MMC advised the agencies that MMC will be the owner and operator of the Montanore Project. Consistent with that indication, Newhi has re-conveyed HR 133 and HR 134 to MMC, and MMI and MMC have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC for modification to DEQ Operating Permit #00150. MMC submitted an updated Plan of Operations to the agencies in 2008 that clarified differences between the 2005 Plan of Operations and DEQ Operating Permit #00150. It also incorporated plans required by DEQ Operating Permit #00150 and additional environmental data collected since 2005. With minor exceptions, MMC proposes to construct, operate, and reclaim a new mine and transmission line in accordance with the terms and conditions of DEQ Operating Permit #00150 and in accordance with the terms and conditions of the other agencies' permits and

approvals issued to Noranda in 1992 and 1993. The requested changes to DEQ Operating Permit #00150 are:

- Construction of an additional underground ventilation infrastructure that would disturb about 1 acre of private land near Rock Lake
- Relocation of the concentrate loadout facility to the Kootenai Business Park located in Libby (private land) resulting in less than 1 acre of disturbance
- Installation of a buried powerline along the Bear Creek Road (NFS road #278), which would be reconstructed for access
- Construction of a temporary electrical substation adjacent to the Ramsey Creek Road (NFS road #4781), which would be reconstructed for access
- A change in the construction technique proposed for the Little Cherry Creek Impoundment from downstream to centerline
- Installation of a water pipeline from the Libby Adit to the land application and disposal (LAD) Areas

Other changes may be required to conform Operating Permit #00150 to the alternative selected by the KNF. MMC and the DEQ agreed to hold the request for modification to the permit in abeyance until completion of the environmental review process.

MMC's Plan of Operations is considered as a new Plan of Operations by the KNF because Noranda relinquished the federal authorization to construct and operate the Montanore Project in 2002. Both the KNF and the DEQ consider MMC's proposed 230-kV North Miller Creek transmission line to be part of the Proposed Action as the 1993 Certificate of Environmental Compatibility and Public Need for the 230-kV transmission line expired.

## Libby Adit Evaluation Program

Following the acquisition of Noranda and DEQ Operating Permit #00150, MMC submitted, and the DEQ approved in 2006, two requests for minor revisions to DEQ Operating Permit #00150 (MR 06-001 and MR 06-002). The KNF has not approved any activities at the Libby Adit that may affect National Forest System lands. The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that Noranda began in 1989. The key elements of the revisions include: excavation of the Libby Adit portal; initiation of water treatability analyses; installation of ancillary facilities; dewatering of the Libby Adit decline; extension of the current drift; and underground drilling and sample collection.

The KNF determined the activities associated with the Libby Adit evaluation drilling were a new proposed Plan of Operations under the Federal Locatable Minerals Regulations (36 CFR 228 Subpart A), and MMC needed KNF approval prior to dewatering and continuing excavation, drilling, and development work at the Libby Adit. Under the authority of Minor Revision 06-002 of the DEQ operating permit, MMC has installed a water treatment plant and is allowed to treat free flowing water from the adit.

In 2006, the KNF initiated a NEPA analysis that included public scoping for the proposed road use and evaluation drilling at the Libby Adit Site. In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider this

activity as the initial phase for the overall Montanore Project EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4.

## Purpose and Need

The Forest Service's and DEQ's overall purpose and need is to process MMC's Plan of Operations, permit applications and application for modification of DEQ Operating Permit #00150, and follow all applicable laws, regulations, and policies pertaining to each pending application. The need, from the perspective of the Forest Service, is to:

- Respond to MMC's proposed Plan of Operations to develop and mine the Montanore copper and silver deposit
- Ensure the selected alternative would comply with other applicable federal and state laws and regulations
- Ensure the selected alternative, where feasible, would minimize adverse environmental impacts on National Forest System surface resources
- Ensure measures would be included, where practicable, that provide for reclamation of the surface disturbance

In accordance with the Clean Water Act, the Corps is required to consider and express the activity's underlying purpose and need from the applicant's and public's perspectives. From the Corps' perspective, the underlying project purpose is to provide copper and silver from deposits contained in northwestern Montana in an economically viable manner to meet a portion of current and future public demands.

The MEPA and its implementing rules ARM 17.4.601 *et seq.*, require that EISs prepared by state agencies include a description of the purpose and benefits of the proposed project. MMC's project purpose is described below. Benefits of the proposed project include increased employment in the project area, increased tax payments, and the production of copper and silver to help meet public demand for these metals. The Major Facility Siting Act (MFSA) (75-20-101 *et seq.*, Montana Code Annotated (MCA) and an implementing rule, ARM 17.20.920, require that the DEQ determine the basis of the need for a facility and that an application for an electric transmission line contain an explanation of the need for the facility. No electrical distribution system is near the project area. The nearest electrical distribution line parallels U.S. 2 and it is not adequate to carry the required electrical power. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

BPA's transmission system in northwestern Montana provides reliable power to BPA's customers. BPA has a need therefore to improve its transmission system to ensure continued reliable electrical power for all of its customers. BPA's purposes are goals to be achieved while meeting the need for the project; the goals are used to evaluate the alternatives proposed to meet the need.

MMC's project purpose is to develop and mine the Montanore copper and silver deposit by underground mining methods with the expectation of making a profit. MMC's need is to receive all necessary governmental authorizations to construct, operate, and reclaim the proposed Montanore Mine and the associated transmission line, and all other incidental facilities. MMC proposes to construct, operate, and reclaim the Montanore Project in an environmentally sound

manner, subject to reasonable mitigation measures designed to avoid or minimize environmental impacts to the extent practicable.

## Decisions

The KNF Supervisor will issue a decision on MMC's proposal in a ROD. The decision objective is to select an action that meets the legal rights of MMC, while protecting the environment in compliance with applicable laws, regulations, and policy. The KNF Supervisor will use the EIS process to develop the necessary information to make an informed decision as required by 36 CFR 228, Subpart A. The Corps will decide whether to provide a 404 permit based on MMC's 404 permit application and information in this EIS. MMC will submit a Section 404 permit application to the Corps for the alternative selected by the lead agencies. The Corps will issue a ROD on its permit decision. Before deciding to provide a tap for electrical power for MMC's project, the BPA will prepare a decision document for its part of the project. The U.S. Fish and Wildlife Service (USFWS) will decide if implementation of the project would jeopardize the continued existence of any species listed or proposed as threatened or endangered under the Endangered Species Act (ESA), or adversely modify critical or proposed critical habitat for a threatened or endangered species, based on a biological assessment (BA) prepared by the KNF. The DEQ will issue a ROD containing its decisions pursuant to each of the project-related permit applications including MMC's MFSA certificate of compliance application, MPDES, air quality, and other permit applications, and a decision on MMC's application for modification of DEQ Operating Permit #00150.

## Public Involvement

A Notice of Intent was published in the *Federal Register* on July 15, 2005. The Notice described KNF and DEQ's intent to prepare an EIS for the proposed Montanore Project, set the dates for public scoping meetings, and solicited public comments. In addition, as part of the public involvement process, the lead agencies issued press releases, mailed scoping announcements, and held three public meetings. Based on the comments received during public scoping, the KNF and the DEQ identified seven key issues that drove alternative development. The key issues that led the lead agencies to develop alternatives to the Proposed Action were:

- Issue 1: Potential for acid rock drainage and near neutral pH metal leaching
- Issue 2: Effects on quality and quantity of surface and ground water resources
- Issue 3: Effects on fish and other aquatic life and their habitats
- Issue 4: Changes in the project area's scenic quality
- Issue 5: Effects on threatened and endangered wildlife species
- Issue 6: Effects on wildlife and their habitats
- Issue 7: Effects on wetlands and non-wetland waters of the U.S.

## Alternatives

Alternatives were developed based on requirements for alternatives under regulations implementing NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the agencies separated the proposed Montanore Project into components. Components are discrete activities or facilities (*e.g.*, plant site or tailings

impoundment) that, when combined with other components, form an alternative. Options were identified for each component. An option is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as paste tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. The agencies considered options for the following project components:

- Underground mine
- Plant site and adits
- Tailings disposal methods and impoundment location
- Land application disposal areas
- Access road
- Transmission line

Besides a No Action and a Proposed Action for both the mine facilities and transmission line, the lead agencies analyzed in detail two mine alternatives and three transmission line alternatives.

## Mine Alternatives

### Alternative 1—No Action, No Mine

Under this alternative, MMC would not develop the Montanore Project, although it is approved under DEQ Operating Permit #00150. The Montanore Project cannot be implemented without a corresponding KNF approval of the Plan of Operations. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the mine or a transmission line. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. The conditions under which the KNF could select Alternative 1 or DEQ deny the MPDES and air quality permits, transmission line certificate, and MMC's operating permit modifications are described in section 1.6, *Agency Roles, Responsibilities, and Decisions* of Chapter 1 of the EIS.

### Alternative 2—MMC's Proposed Mine

As proposed by MMC, the Montanore Project would consist initially of a 12,500-tons-per-day underground mining operation that would expand to a 20,000-tons-per-day rate. The surface mill (the Ramsey Plant Site) would be located on National Forest System lands outside of the CMW in the Ramsey Creek drainage. The proposed project also would require constructing about 16 miles of high-voltage electric transmission line from a new substation adjacent to BPA's Noxon-Libby transmission line to the project site. The 230-kilovolt (kV) transmission line alignment would be from the Sedlak Park Substation in Pleasant Valley along U.S. 2, and then up the Miller Creek drainage to the project site. The proposed transmission line is considered as a separate alternative below (see Alternative B). The location of the proposed project facilities is shown on Figure S-1.

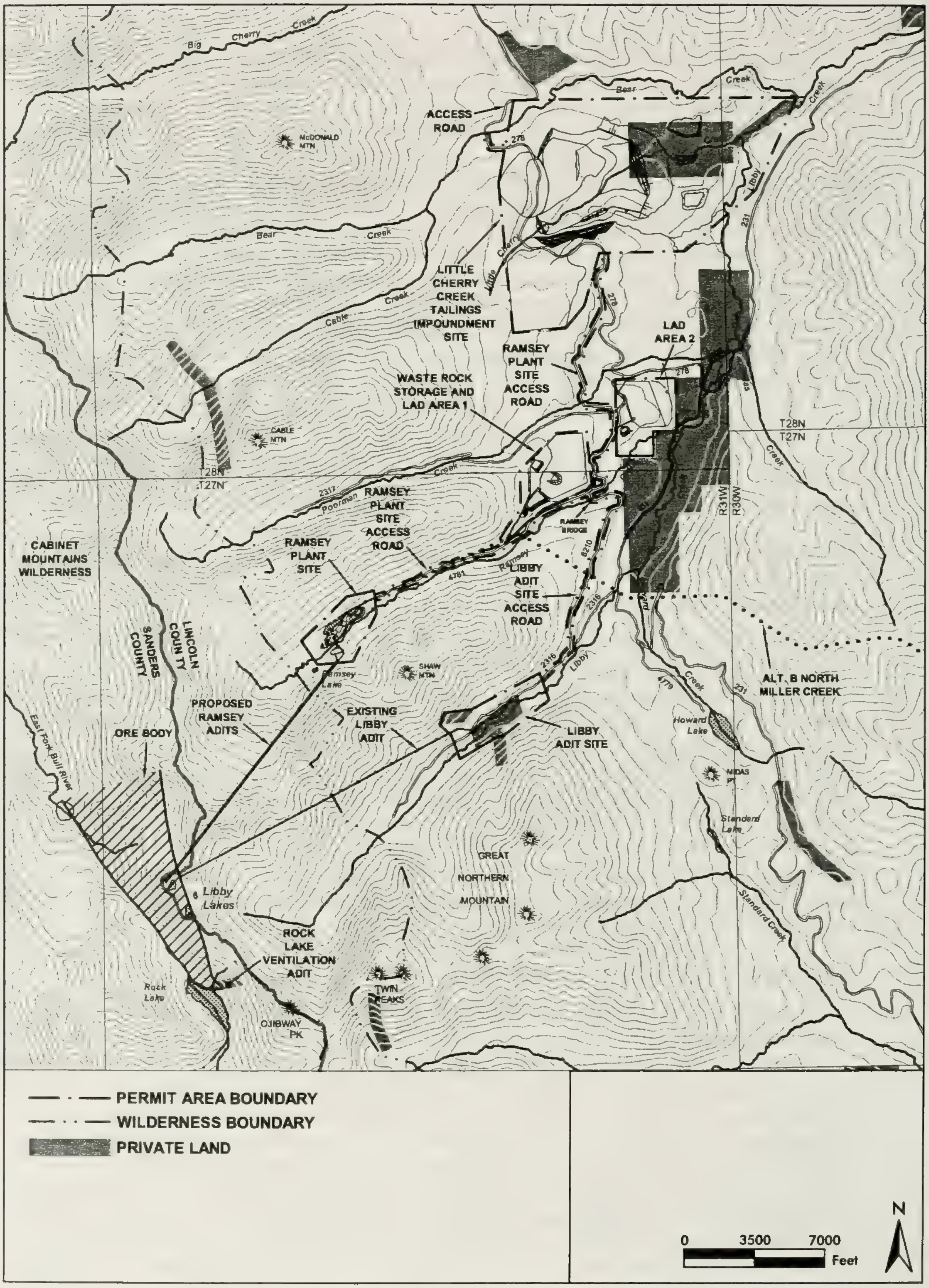



Figure S-1. Mine Facilities and Permit Areas, Alternative 2

The ore body would be accessed from two adits adjacent to the mill. Two other adits, an evaluation/ventilation adit and a ventilation adit, both with entrances located on private land, also would be used during the project. The evaluation/ventilation adit would be located in the upper Libby Creek drainage; the ventilation adit would be located on MMC's private land (patented claim HR 134) in the upper East Fork Rock Creek drainage near Rock Lake. The additional 1-acre disturbance for the ventilation adit is part of MMC's requested DEQ Operating Permit #00150 modifications.

The mineralized resource associated with the Montanore subdeposit is about 135 million tons. MMC anticipates mining up to 120 million tons. Ore would be crushed underground and conveyed to the surface plant located near the Ramsey Adits. Copper and silver minerals would be removed from the ore by a flotation process. Tailings from the milling process would be transported through a pipeline to a tailings impoundment located in the Little Cherry Creek drainage, about 4 miles from the Ramsey Plant Site.

Access to the mine and all surface facilities would be via U.S. 2 and the existing National Forest System road #278, the Bear Creek Road. (Road names and numbers are used interchangeably in this EIS; a complete list of all road names and numbers is in Appendix B in the EIS.) With the exception of the Bear Creek Road, all open roads in the proposed operating permit areas would be gated and limited to mine traffic only. MMC would upgrade 11 miles of the Bear Creek Road and build 1.7 miles of new road between the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site. Silver/copper concentrate from the plant would be transported by truck to a rail siding in Libby, Montana. The rail siding and Libby Loadout facility are near one of the facilities considered in the 1992 Final EIS. The concentrate would then be shipped by rail to an out-of-state smelting facility.

MMC would discharge excess mine and adit wastewater at one of two LAD Areas. Additional water treatment would be added as necessary prior to discharge at the LAD Areas. Water treatment also would continue at the Libby Adit Site, if necessary. MMC would be required to submit a complete MPDES application for all additional outfalls. Additional proposed discharges include the LAD Areas, the Ramsey Plant Site, and the Little Cherry Creek Tailings Impoundment Site should this alternative be selected.

Mining operations would continue for an estimated 16 years once facility development was completed and actual mining operations started. Three additional years may be needed to mine 120 million tons. The mill would operate on a three-shifts-per-day, seven-days-per-week, year-long schedule. At full production, an estimated 7 million tons of ore would be produced annually during a 350-day production year. Employment numbers are estimated to be 450 people at full production. An annual payroll of $12 million is projected for full production periods.

The operating permit area would be 3,628 acres and the disturbance area would be 2,582 acres (Table S-1). The operating permit area would encompass 433 acres of private land owned by MMC for the proposed mine and associated facilities. All surface disturbances would be outside the CMW. MMC has developed a reclamation plan to reclaim disturbed areas.

**Table S-1. Mine Surface Area Disturbance and Operating Permit Areas, Alternatives 2-4.**

| Facility | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|
| | Disturbance Area† (acres) | Permit Area (acres) | Disturbance Area† (acres) | Permit Area (acres) | Disturbance Area† (acres) | Permit Area (acres) |
| Existing Libby Adit Site | 22 | 219 | 22 | 219 | 22 | 219 |
| Upper Libby Adit | 0 | 0 | 1 | 1 | 1 | 1 |
| Rock Lake Ventilation Adit | 1 | 1 | 1 | 1 | 1 | 1 |
| Plant Site and Adits | 52 | 185 | 110 | 172 | 110 | 172 |
| Tailings Impoundment | 1,928 | 2,458 | 1,359 | 1,585 | 1,602 | 2,191 |
| LAD Area 1 and Waste Rock Storage Area§ | 247 | 261 | 260 | 277 | 260 | 277 |
| LAD Area 2 | 183 | 226 | 123 | 196 | 123 | 196 |
| Access Roads† | 149 | 278 | 135 | 155 | 135 | 188 |
| Total | 2,582 | 3,628 | 2,011 | 2,606 | 2,254 | 3,245 |

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.
§Waste rock would be stored within the disturbance area of the tailings impoundment in Alternatives 3 and 4, and not at LAD Area 1.

## Alternative 3—Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies to reduce or eliminate adverse environmental impacts. These measures are in addition to or instead of the mitigations proposed by MMC. The Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility. All other aspects of MMC's mine proposal would remain as described in Alternative 2.

In Alternative 3, four major mine facilities would be located in alternative locations (Figure S-2). MMC would develop a Poorman Tailings Impoundment Site north of Poorman Creek for tailings disposal, use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed operating permit and disturbance areas at LAD Areas 1 and 2 to avoid important resources (Figure S-3). The Poorman Tailings Impoundment Site was retained for detailed analysis because it would avoid the diversion of a perennial stream (Issue 2) and minimize wetland effects (Issue 7). In Alternative 2, MMC's proposed tailings impoundment would be in Little Cherry Creek, a perennial stream, and the impoundment would require the permanent diversion of the upper watershed of Little Cherry Creek. Numerous wetlands and springs are in the Little Cherry Creek Impoundment Site.

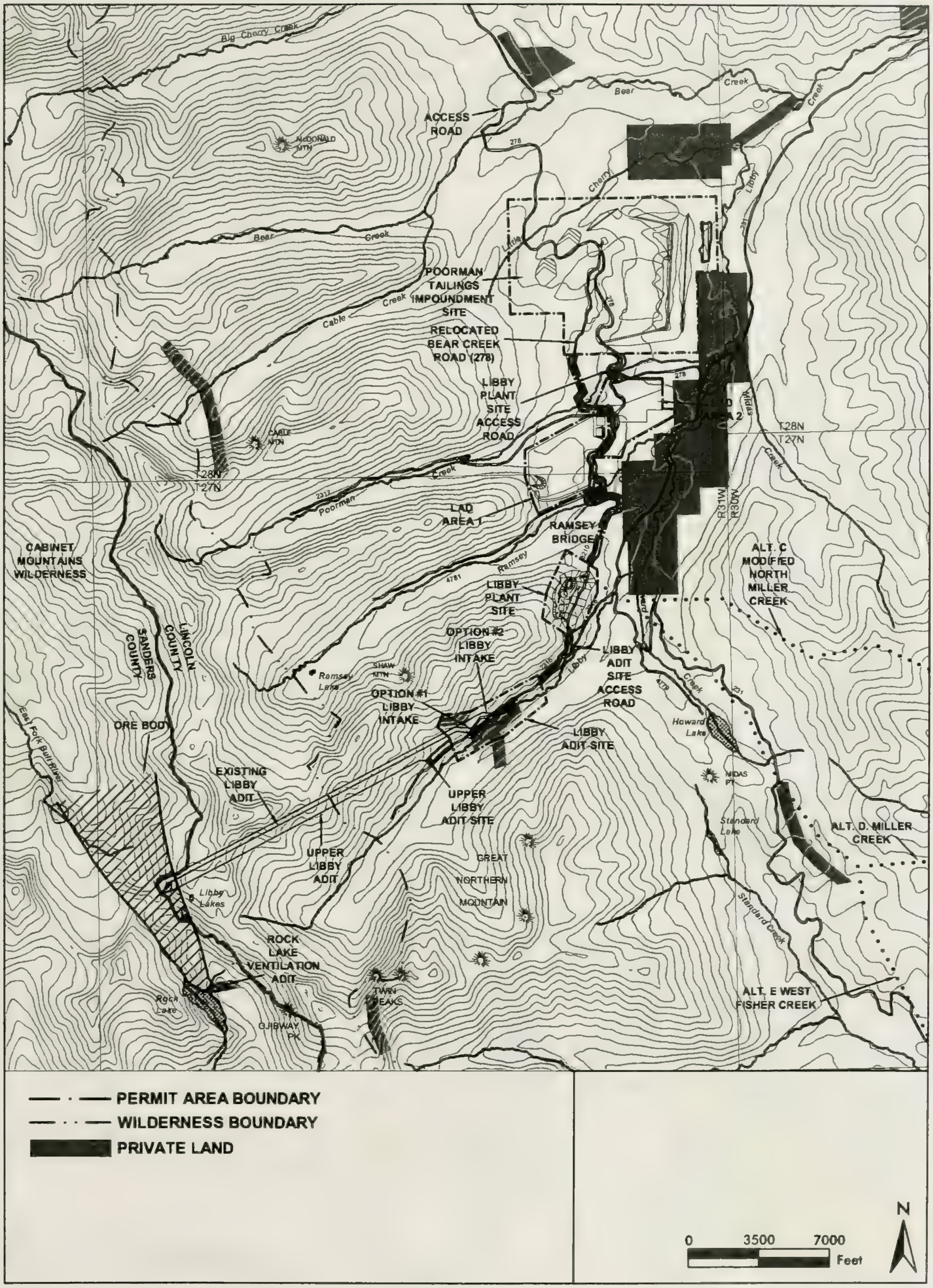



Figure S-2. Mine Facilities and Permit Areas, Alternative 3

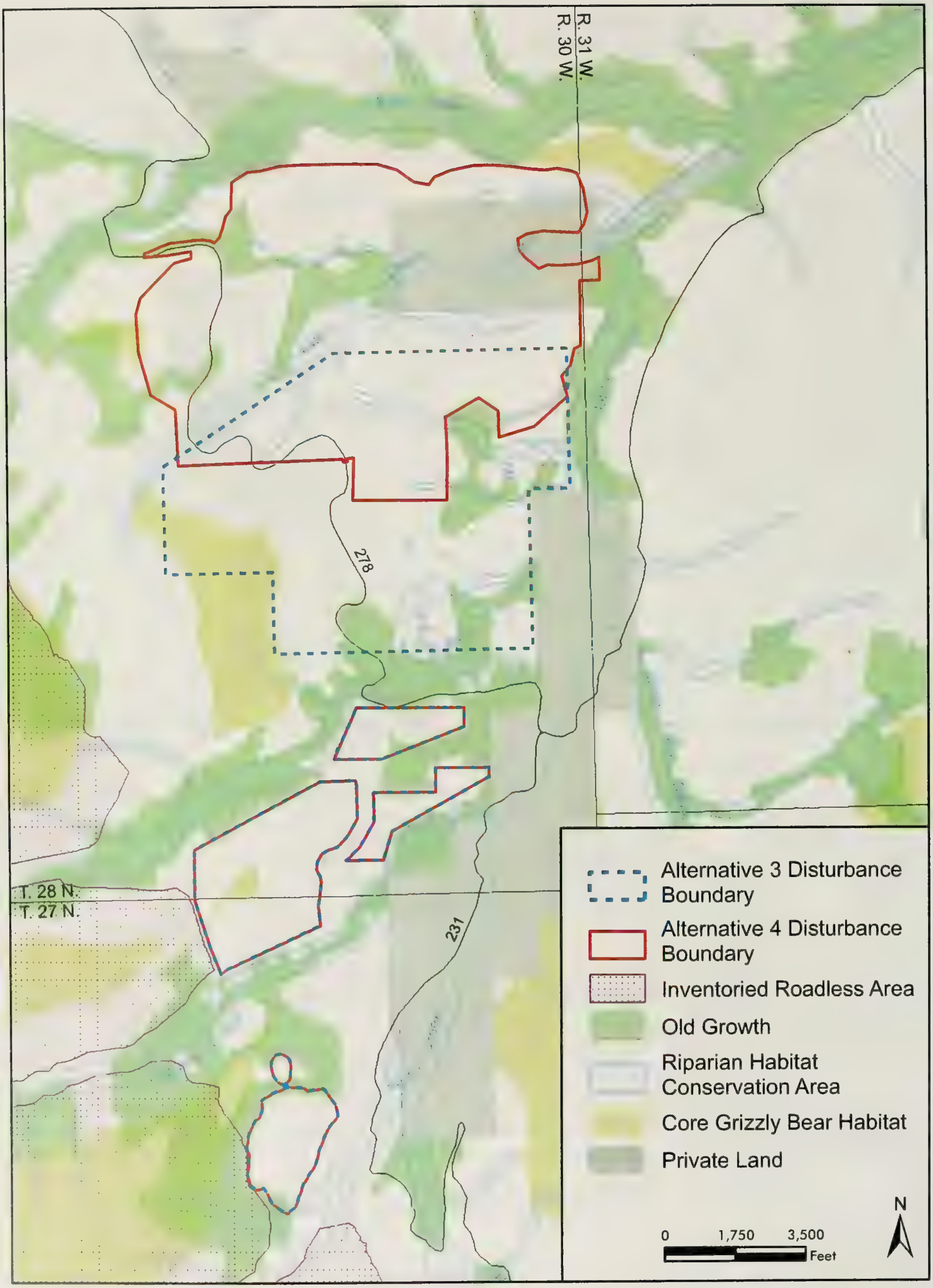


Figure S-3. Key Resources Avoided by Alternatives 3 and 4

MMC's proposed plant site in the upper Ramsey Creek drainage would affect Riparian Habitat Conservation Areas (RHCAs) (Issue 3), core grizzly bear habitat (Issue 5), and Inventoried Roadless Areas (IRAs). An alternative site on a ridge separating Libby and Ramsey creeks was retained for detailed analysis to address these issues. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would address acid rock drainage and metal leaching (Issue 1). To avoid disturbance in the upper Ramsey Creek drainage, the adits in Alternative 3 would be in the upper Libby Creek drainage. This modification would address the same issues as the alternate Libby Plant Site (Issues 3 and 5).

MMC's proposed LAD Area 1 would disturb RHCAs (Issue 3), old growth (Issue 6), and IRAs; LAD Area 2 would disturb old growth. In Alternative 3, the lead agencies modified the permit areas and disturbance areas for the LAD Areas to address these issues (Figure S-3).

In Alternative 2, MMC would discharge mine and adit wastewater from the Ramsey Adits at two LAD Areas. Water would be treated at the Libby Water Treatment Plant or a water treatment plant at the Ramsey Plant Site if necessary to meet MPDES discharge limitations. In Alternatives 3 and 4, the lead agencies modified the proposed water management plan to address the uncertainties about quality of the mine and adit inflows, the effectiveness of LAD for primary treatment, quantity of water that the LAD Areas would be capable of receiving and the effect on surface and ground water quality. In Alternatives 3 and 4, in addition to the existing water treatment plant at the Libby Adit, another water treatment system may be necessary at higher wastewater volumes to comply with water quality standards or BHES Order limits prior to disposal at the LAD Areas. These modifications would address Issue 2, water quality and quantity.

The operating permit area would be 2,606 acres and the disturbance area would be 2,011 acres (Table S-1). The operating permit area would encompass 83 acres of private land owned by MMC for the proposed mine and associated facilities.

MMC would plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. MMC would install a gate on the Libby Creek Road and maintain the gate and the KNF would seasonally restrict access on the two roads as long as MMC uses and snowplows the two roads.

In Alternative 3, MMC would use the same roads as Alternative 2 for main access during operations. About 13 miles of Bear Creek Road (National Forest System road #278), from U.S. 2 to the Poorman Tailings Impoundment Site, would be paved and upgraded to a roadway width of 26 feet. South of Little Cherry Creek, MMC would build 3.2 miles of new road west of Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781). The new road would be designated NFS road #278 (the new Bear Creek Road) and would generally follow the 3,800-foot contour to north of the Poorman Creek bridge. To maintain a public access connection between the Bear Creek Road and the Libby Creek Road (NFS road #231), the public would use the new Bear Creek Road, a segment of the Poorman Creek Road (NFS road #2317), and a segment of the Bear Creek Road south of Poorman Creek.

### Alternative 4—Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. As in Alternative 3, the Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility.

In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed permit and disturbance areas at the LAD Areas, as in Alternative 3 (Figure S-4). In addition to the modifications from Alternative 3, MMC would modify the proposed Little Cherry Creek Tailings Impoundment Site operating permit and disturbance areas to avoid RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage. Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint, and to minimize disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6) (Figure S-3). Waste rock would be stored temporarily within the impoundment footprint to address acid rock drainage and metal leaching (Issue 1) and water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified so it would adequately convey anticipated flows. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The operating permit area would be 3,245 acres and the disturbance area would be 2,254 acres (Table S-1). The operating permit area would encompass 433 acres of private land owned by MMC for the proposed mine and associated facilities. All other aspects of MMC's mine proposal would remain as described in Alternative 2, as modified by Alternative 3.

A comparison of primary mine development and operation features that vary between each mine alternative is shown in Table S-2.

## Transmission Line Alternatives

### Alternative A—No Transmission Line, No Mine

In this alternative, MMC would not build a 230-kV transmission line to provide power. The BPA would not tap the Noxon-Libby 230-kV transmission line nor would it build the Sedlak Park Substation. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the transmission line. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

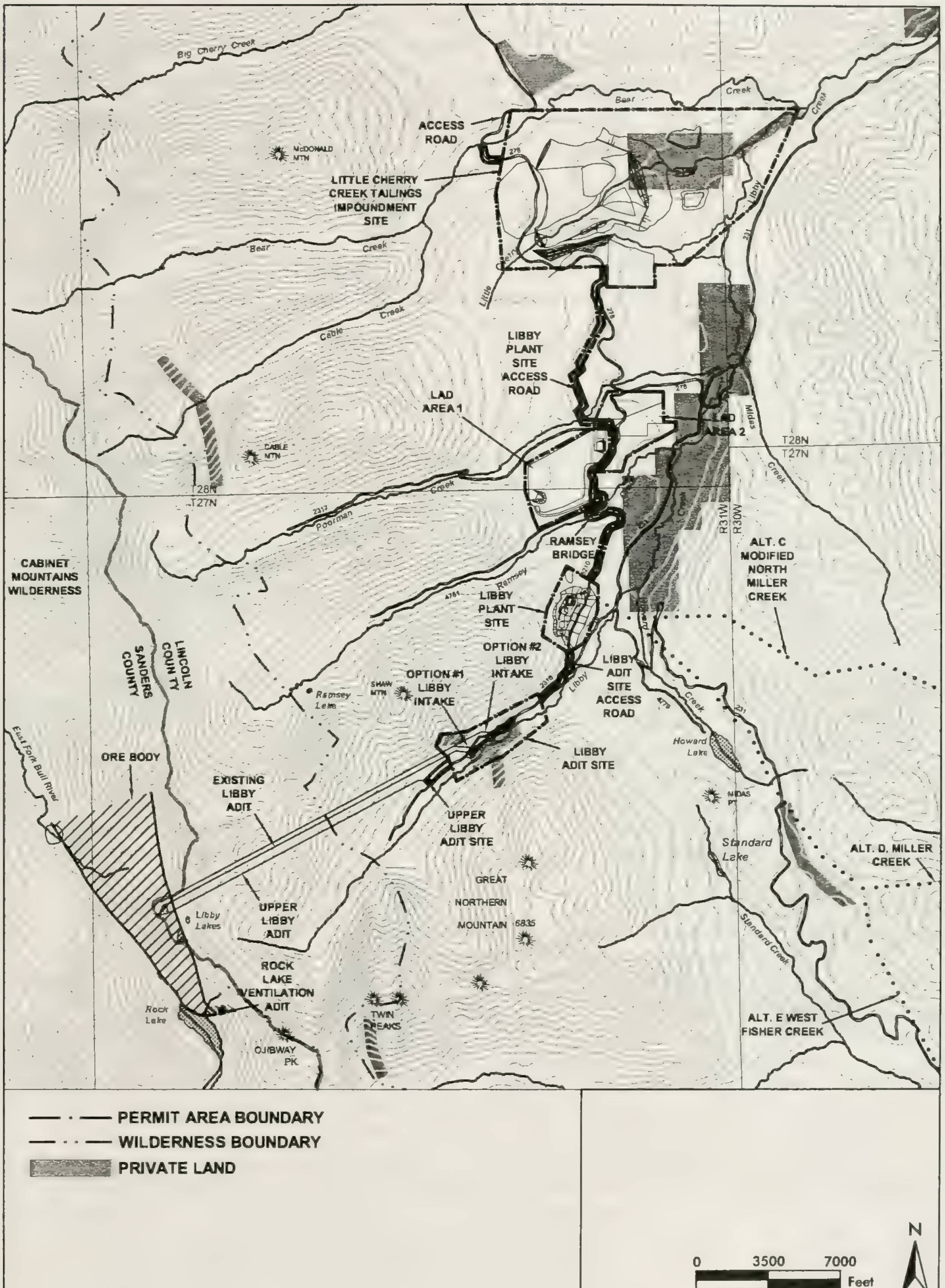



Figure S-4. Mine Facilities and Permit Areas, Alternative 4

**Table S-2. Mine Alternative Comparison.**

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Operating Permit Areas | 3,628 acres | 2,606 acres | 3,245 acres |
| Disturbance Areas | 2,582 acres | 2,011 acres | 2,254 acres |
| ***Primary Facilities*** | | | |
| Mill site | Ramsey Plant Site in valley bottom in Upper Ramsey Creek | Libby Plant Site between Libby and Ramsey Creek drainages | Same as Alternative 3 |
| Adits and portals | Existing Libby Adit; two Ramsey Adits; Rock Lake Ventilation Adit | Existing Libby Adit; two additional Libby Adits; Rock Lake Ventilation Adit | Same as Alternative 3 |
| Above-ground conveyor | 1,200 feet long between Ramsey Adit portal and mill | 6,000 and 7,500 feet long (depending on the option) between Libby Adit Site and Libby Plant Site mill | Same as Alternative 3 |
| Tailings impound-ment and seepage collection pond | 628 acres in Little Cherry Creek | 608 acres between Poorman and Little Cherry creeks | Same as Alternative 2 |
| Perennial stream diversion | Diversion of Little Cherry Creek 10,800 feet long around impoundment to Libby Creek | None | Same as Alternative 2 |
| Land application disposal areas | Two; one along Ramsey Creek and one between Ramsey and Poorman creeks | Two; similar to Alternative 2 with slight boundary modifications | Same as Alternative 3 |
| Water treatment | Land application, Libby Adit Water Treatment Plant, or additional water treatment plant at plant site, as necessary | Same as Alternative 2 | Same as Alternative 2 |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Primary access road | NFS road #278 (Bear Creek Road) plus new access road; 20 to 29 feet wide | NFS road #278 (Bear Creek Road) plus new access road; 26 feet wide; up to 56 feet wide to accommodate haul traffic and public traffic | Same as Alternative 3 |
| Concentrate loadout location | Kootenai Business Park in Libby | Same as Alternative 2 | Same as Alternative 2 |
| ***Facility Details*** | | | |
| New adits:length, grade, and portal elevation | Ramsey Adits: 16,000 feet long, 8% decline; Elevation: 4,400 feet<br>Rock Lake Ventilation Adit: Elevation: 5,560 feet | Upper Libby Adit: 13,700 feet long, 7% decline; Elevation: 4,100 feet<br>New Libby Adit: 17,000 to 18,500 feet long, depending on option; 5% decline; Elevation: 3,960 feet | Same as Alternative 3 |
| New access roads† To Plant Site: | 1.7 miles connecting NFS roads #278 and #4781 | Existing NFS road #6212 and 4781 used for plant site access | Same as Alternative 2 |
| Realigned NFS road #278 at impoundment | 1.8 miles | 3.2 miles of new Bear Creek Road con-necting existing NFS roads #278 and #4781 | Same as Alternative 2 |
| To Adit Portal: | 0.3 mile to portal | None | Same as Alternative 3 |
| To LAD Area 1 | 1.0 mile | 0.7 mile | Same as Alternative 3 |
| To LAD Area 2 | 0.2 mile | 0.2 mile | Same as Alternative 3 |
| Pipelines Tailings | Double-walled, high-density polyethylene adjacent to access road; 6.4 miles to impoundment | Double-walled buried adjacent to access road; 4.2 miles to impoundment | Same as Alternative 3; 6.4 miles to impoundment |
| Reclaim water | High-density polyethylene adjacent to access road | High-density polyethylene buried adjacent to access road | Same as Alternative 3 |
| Tailings pump stations | At Poorman Creek crossing | At each crossing of Ramsey and Poorman creeks | Same as Alternative 3 |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Borrow areas | Four; 143 acres within impoundment footprint and 419 acres outside of impoundment footprint | Three; 124 acres within impoundment footprint and 92 acres outside of impoundment footprint | Five; 185 acres within impoundment footprint and 252 acres outside of impoundment footprint |
| Post-mining impoundment runoff | Riprapped channel to Bear Creek | Natural channel to Little Cherry Creek | Riprapped channel to Little Cherry Creek Diversion Channel |

[†]Temporary roads within the disturbance area of each facility not listed.

### Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alternative)

The Ramsey Plant Site's electrical service would be 230-kV, 3-phase, and 60-cycle, provided by a new, overhead transmission line. BPA's proposed Sedlak Park Substation Site at the Noxon-Libby 230-kV transmission line is in an area known locally as Sedlak Park, 30 miles southeast of Libby on U.S. 2 (Figure S-5). The proposed Sedlak Park Substation Site is the same in all alternatives. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line.

MMC's proposed transmission line alignment would be in the watersheds of the Fisher River, Miller Creek, a tributary to Miller Creek, Midas Creek, Howard Creek, Libby Creek, and Ramsey Creek (Figure S-5). The proposed alignment would head northwest from the substation for about 1 mile paralleling U.S. 2, and then follow the Fisher River and U.S. 2 north 3.3 miles. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then turn northwest and traverse up a tributary to Miller Creek. The alignment would then cross into the upper Midas Creek drainage, and then down to Howard and Libby Creek drainages. The alignment would cross the low ridge between Libby Creek and Ramsey Creek, and then would generally follow Ramsey Creek to the Ramsey Plant Site. The maximum annual energy consumed by the project is estimated at 406,000 megawatts, using a peak demand of 50 megawatts. Access roads on National Forest System lands would be closed and reseeded after the transmission line was built, and reclaimed after the transmission line was removed at the end of operations.

Characteristics of MMC's proposed North Miller Creek Alternative (Alternative B) and the agencies' three other transmission line alternatives (Alternatives C, D, and E) are summarized in Table S-3. MMC's proposed alignment would end at a substation at the Ramsey Plant Site; the lead agencies' alternatives would end at a substation at the Libby Plant Site, which would result in the lead agencies' alternatives being shorter.

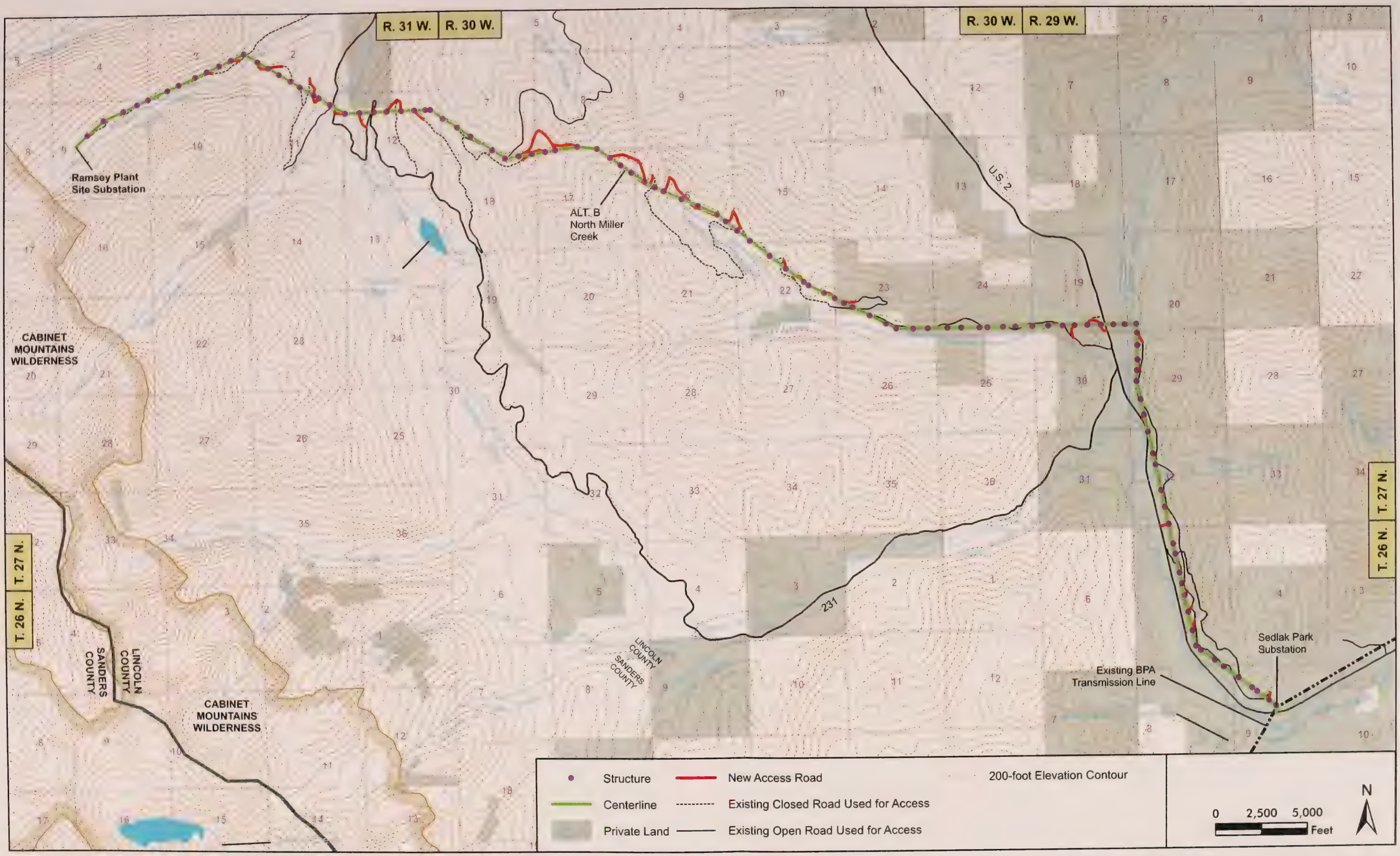



Figure S-5. North Miller Creek Alignment, Structures, and Access Roads, Alternative B

**Table S-3. Transmission Line Alternative Comparison.**

| Characteristic | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| Length (miles)[†] | | | | |
| Steel monopole | 16.4 | 0.0 | 0.0 | 1.4 |
| Wooden H-frame | 0.0 | 13.4 | 14.1 | 13.5 |
| Total | 16.4 | 13.4 | 14.1 | 14.9 |
| Number of structures[‡] | 108 | 80 | 95 | 101 |
| Approximate average span length (ft) | 800 | 885 | 785 | 780 |
| ***Helicopter use*** | | | | |
| Structure placement | At contractor's discretion | 21 structures, primarily in upper unamed tributary of Miller Creek and Midas Creek | 20 structures, primarily in upper Miller Creek | 23 structures, primarily along West Fisher Creek |
| Vegetation clearing | At contractor's discretion | At selected locations; see Figure S-6 | At selected locations; see Figure S-6 | At selected locations; see Figure S-6 |
| Line stringing | At contractor's discretion | Yes, entire line | Yes, entire line | Yes, entire line |
| Annual inspection | Yes | Yes | Yes | Yes |
| ***Estimated cost in millions of 2008 $***[¶] | | | | |
| Construction | $7.3 | $5.4 | $5.8 | $6.0 |
| Mitigation | $14.9 | $14.4 | $14.5 | $15.0 |

[†]Length is based on line termination at the Ramsey Plant Site in Alternative B and the Libby Plant Site in the other three alternatives.
[‡]Number and location of structures based on preliminary design, and may change during final design. The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans.
[¶]Estimated cost used reasonable assumptions regarding costs of construction materials, clearing, land acquisition, and engineering. Final cost could vary from those shown. Estimated construction cost by HDR Engineering, Inc. 2008; estimated construction cost by ERO Resources Corp. 2008.

### Alternative C—Modified North Miller Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal described under Alternative B. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

The primary modification to MMC's proposed North Miller Creek alignment in Alternative B would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River (Figure S-6). This modification would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive and subject to high sediment delivery. The alignment also would be out of the Fisher River floodplain. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from U.S. 2. Fewer residences would be within 0.5 mile of the line. Other modifications to the alignment are relatively small shifts along Miller Creek and an unnamed tributary to Miller Creek. During final design, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval. The plan's goal would be to minimize vegetation clearing. The modifications were made to avoid and minimize effects on RHCAs along drainages, and to avoid steep slopes in the headwaters of the unnamed tributary of Miller Creek (Issues 2 and 3).

Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on Alternative C. In some locations, a helicopter would be used for vegetation clearing and structure construction (Figure S-6). The lead agencies selected helicopter use so the need to use or construct roads in or adjacent to core grizzly bear habitat was eliminated. Helicopter use also would reduce effects on lynx habitat. Access roads on National Forest System lands would be placed into intermittent stored service after construction, and decommissioned after the transmission line was removed at the end of operations. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. Modifications described under Alternative 3 for the mine, such as seed mixtures, revegetation success, and weed control, would be implemented in Alternative C.

The agencies developed mitigation measures that would reduce or minimize the effects of the transmission line in Alternatives C, D, and E. Snags and up to 30 tons per acre of coarse woody debris would be left in the clearing area. No transmission line construction in elk, white-tailed deer, or moose winter range would occur between December 1 and April 30 unless approved by the agencies. The KNF would change the access on five roads to provide big game security habitat. MMC would fund or conduct field and/or aerial reconnaissance surveys to locate any new bald eagle or osprey nests along specific segments of the transmission line corridor. MMC would complete surveys to locate active nests in appropriate habitat, or would not remove vegetation in the nesting season. To mitigate effects on the grizzly bear, MMC would secure or protect replacement grizzly bear habitat on 24 acres of private lands and enhance grizzly bear habitat on 11,324 acres of private lands in the Cabinet-Yaak Ecosystem. The KNF would change the access in 2.8 miles of NFS road #4725 in an unnamed tributary of Miller Creek in Alternative C and 4.2 miles in Alternatives D and E.

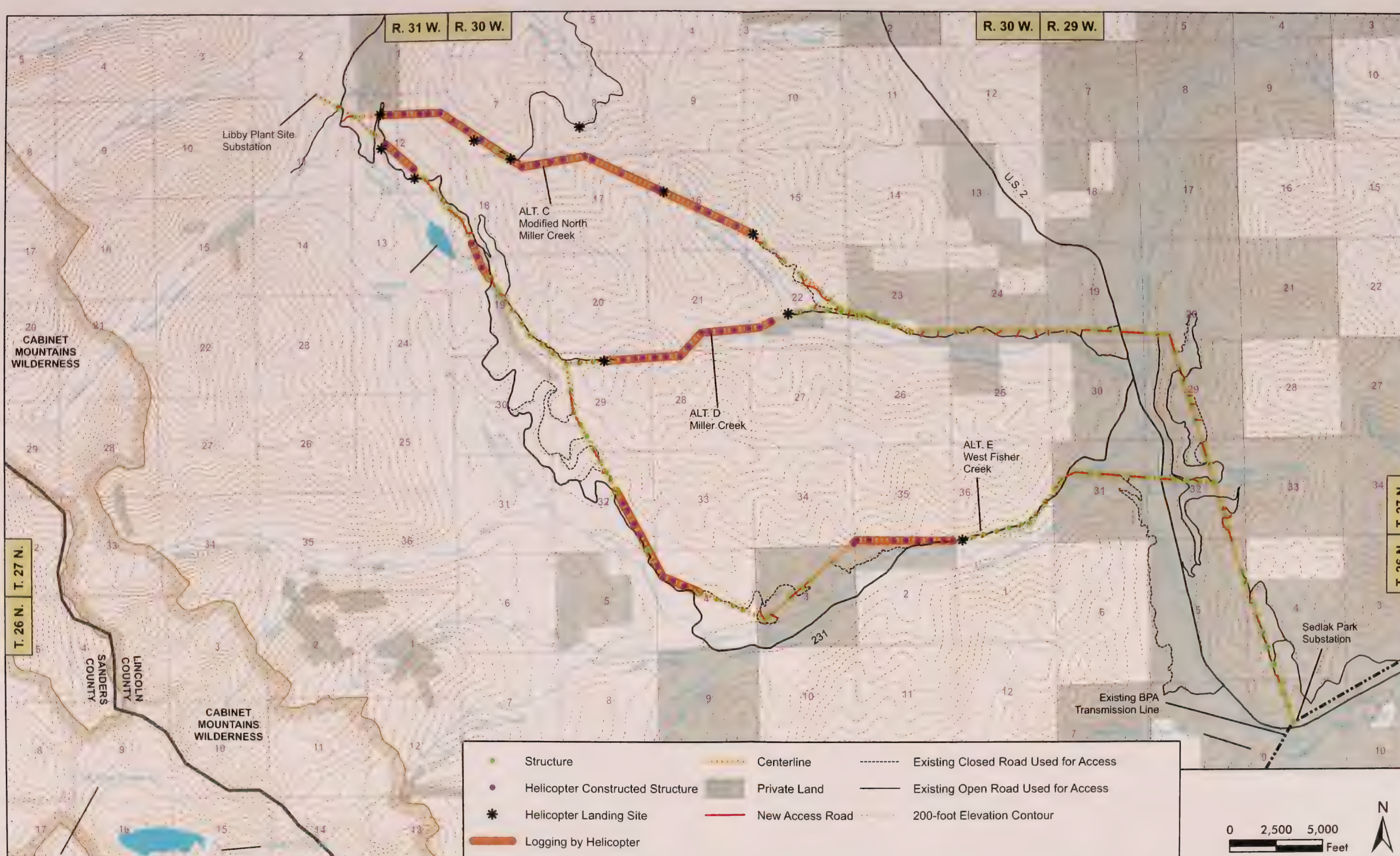



Figure S-6. Transmission Line Alignment, Structures, and Access Roads, Alternatives C-E

## Alternative D—Miller Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, and other modifications described under Alternative C. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

As in the Modified North Miller Creek Alternative (Alternative C), this alternative modifies MMC's proposed North Miller Creek alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation (Figure S-6). The development of a final Vegetation Removal and Disposition Plan would be the same as Alternative C. The modifications would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive and subject to high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from U.S. 2. Fewer residences would be within 0.5 mile of the line. Other modifications to the alignment are relatively small shifts along Miller Creek to avoid RHCAs along drainages (Issue 3). The issue of effects on threatened or endangered species (Issue 5) was addressed by routing the alignment along Miller Creek and avoiding core grizzly bear and lynx habitat in North Miller Creek and the unnamed tributary of Miller Creek.

This alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. In the 1992 Final EIS, a similar alignment was considered, but was eliminated in part because of visual concerns from Howard Lake. The issue of scenic quality from Howard Lake was addressed by using H-frame structures, which would be shorter than steel monopoles. More detailed engineering was completed and H-frame structures would be used to minimize the visibility of the line from Howard Lake (Issue 4).

As in Alternative C, a helicopter would be used for timber clearing and structure construction in some locations (Figure S-6). New access roads on National Forest System lands would be managed in the same manner as Alternative C. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads.

## Alternative E—West Fisher Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, and other modifications described under Alternative C. Some steel monopoles would be used in the steep section 2 miles west of U.S. 2 (Figure S-6). This alternative could be selected with any of the mine alternatives. For analysis purposes, the lead agencies assumed this alternative would terminate at the Libby Plant Site.

As in the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. The modification would address issues associated with water quality (Issue 2) by crossing less area with soils that are highly erosive and subject to high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from U.S. 2. Fewer residences would be within 0.5 mile of the line.

The primary difference between the West Fisher Creek Alternative (Alternative E) and the North Miller Creek Alternative (Alternative B) is routing the line on the north side of West Fisher Creek

and not up the Miller Creek drainage to minimize effects on core grizzly bear habitat. As in the Miller Creek Alternative (Alternative D), this alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on this alternative in most locations to minimize the visibility of the line from Howard Lake (Issue 4). In some locations, a helicopter would be used for timber clearing and structure construction (Figure S-6). New access roads on National Forest System lands would be managed in the same manner as Alternative C. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads.

## Forest Plan Amendment

Each mine and transmission line alternative would require an amendment to the 1987 Kootenai Land and Resource Management Plan, as known as the Kootenai Forest Plan (KFP) in order for the alternative to be consistent with the plan (USDA Forest Service 1987). The amendment would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 and Forest Service Manual 1921.03.

### Mine Facilities

In the 1993 ROD approving the lead agencies' preferred alternative for Noranda's proposed Montanore Project, the KNF amended the KFP and reallocated an area surrounding the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site to Management Area 31 (MA 31). Maps showing existing MAs are available at the KNF. MA 31 is designed to accommodate the activities associated with mineral development on the KNF. Because of improved mapping capabilities between 1993 and 2007 and a slight change in the Little Cherry Creek Tailings Impoundment design from that approved in 1993, all areas currently proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Tailings Impoundment Site were not previously reallocated to MA 31. In mine Alternatives 2, 3 and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of the selected plant site, the tailings impoundment, and LAD Areas 1 and 2 that currently are not MA 31. In addition, a proposed road and facility corridor that would cross MA 13 (Designated Old Growth) would be reallocated to MA 31. This amendment would apply only to National Forest System lands disturbed by any mine alternative, and would not apply to private lands affected by the mine alternatives.

### 230-kV Transmission Line

In the 1993 ROD approving the lead agencies' preferred alternative for Noranda's proposed Montanore Project, the KNF amended the KFP and reallocated areas crossed by the transmission line classified as corridor avoidance areas (224 acres) to Management Area 23 (MA 23). Maps showing existing MAs are available at the KNF. MA 23 is designed to accommodate the activities associated with electric transmission corridors on the KNF (USDA Forest Service 1987). Because of improved mapping capabilities between 1993 and 2007 and slight changes in the North Miller Creek transmission line alignment from that approved in 1993, all areas currently proposed for disturbance by MMC's proposed transmission line alignment classified as corridor avoidance areas were not reallocated to MA 23. In transmission line Alternatives B, C, D, and E, the KNF would amend the KFP by reallocating certain areas within a 500-foot corridor of the selected 230-

kV transmission line on National Forest System lands as MA 23. This amendment would apply only to certain National Forest System lands currently not MA 23 disturbed by any transmission line alternative, and would not apply to private lands crossed by the transmission line alternatives. The amendment would apply to the following MAs if crossed by the transmission line under the conditions described:

- MAs 10 and 11 if the proposed corridor is within grizzly bear Management Situation 1 or 2
- MAs 2, 6, 12, 13, and 14

The KFP requires wildlife habitat and security be maintained in MAs 15, 16, 17, and 18 by limiting open road density (ORD) to less than or equal to 3.0 miles per square mile. ORD in MAs 15, 16, 17, and 18 is currently greater than the standard in the Crazy Planning Subunit (PSU), which is a KNF planning area potentially affected by the proposed project. In transmission line Alternatives B, C, D, and E, the KNF would amend the KFP by allowing the ORD to exceed the KFP standard in the Crazy PSU during and after the project.

## Affected Environment

The project is in the KNF, 18 miles south of Libby, Montana. Elevation of the project area ranges from 2,600 feet along U.S. 2 to nearly 8,000 feet in the Cabinet Mountains. Most of the area is forested. Annual precipitation varies over the area, and is influenced by elevation and topography. Precipitation is between 30 and 50 inches where most project facilities would be located. Two tributaries of the Kootenai River, Libby Creek and the Fisher River, provide surface water drainage for most of the project area. The ore body is beneath the CMW and all access and surface facilities would be located outside of the CMW boundary. The analysis area is drained by East Fork Rock Creek, a tributary of the Clark Fork River, the East Fork Bull River, Libby Creek, and tributaries to the Fisher River. Most of the area is National Forest System lands managed in accordance with the KFP. Private land, most of which is owned by MMC or Plum Creek Timber Company, is found in the project area, particularly along the first 3 to 6 miles of the transmission line corridors. Recreation, wildlife habitat, and timber harvesting are the predominant land uses. Chapter 3 provides more information about the affected environment.

## Environmental Consequences

The following two sections summarize the environmental consequences of the four mine and five transmission line alternatives. The effects of the mine alternatives are summarized for the seven key issues discussed in the previous *Public Involvement* section. For the transmission line, the DEQ requires a certificate of compliance for development of electric transmission lines. The DEQ must find that the selected alternative meets the set of criteria listed under 75-20-301, MCA to be eligible for transmission line certification. Findings for all criteria under each alternative are summarized in the following *Draft Findings for Transmission Line Certification Approval* section.

## Mine Alternatives

### Issue 1: Potential for Acid Rock Drainage and Near Neutral pH Metal Leaching

The mineral deposit proposed for mining is part of the Rock Creek-Montanore deposit. The Rock Creek-Montanore deposit has two sub-deposits, the Rock Lake sub-deposit and the Montanore sub-deposit. The Troy Mine, developed within the upper quartzites of the Revett Formation, is a depositional and mineralogical analog for the zone of quartzite to be mined within the upper-most part of the lower Revett Formation at the Montanore sub-deposit. Geological analogs are valuable techniques for predicting acid generation potential and/or water quality from a proposed mine site. This type of comparison is based on the assumption that mineralization formed under comparable conditions within the same geological formation, and that has undergone similar geological alteration and deformation, will have similar mineralogy and texture and, thus, similar potential for oxidation and leaching under comparable weathering conditions. The ability to study environmental geochemical processes in the same rocks at full scale and under real-time weathering conditions provides a valuable basis for evaluation of laboratory test results.

The risk of acid generation for rock exposed in underground workings or for tailings would be low, with some potential for release of select metals at a near-neutral pH (around pH 7) and a high potential for release of nitrogen compounds due to blasting. Low acid generation potential exists for a fraction of the total waste rock volume in portions of the Prichard Formation and moderate potential exists within the halo zones of the Revett Formation, which MMC proposes to mitigate through selective handling (particularly of the barren lead zone) and additional evaluation by sampling and characterization during mine development and operations. Portions of the waste rock at Montanore have the potential to release trace elements at a near-neutral pH.

Some additional sampling would be conducted during final exploration and operations, when a more representative section of waste rock would be available for sampling. Characterization of metal release potential for tailings and waste rock is limited and would be expanded in Alternatives 3 and 4. Descriptions of mineralogy in rocks exposed in the evaluation adit ore zone (for the Revett Formation) and development adits (for the Burke and Prichard Formations) would be used to identify subpopulations with sulfide halo zone overprints and their relative importance in terms of tonnage to be mined, to guide sampling density. If the Wallace Formation were intercepted, samples of this lithology would be collected and characterized. This information would be used to redefine geochemical units for characterization and evaluate potential selective handling and encapsulation requirements.

Although waste rock would only be stockpiled for a short period of time near LAD Area 1 in Alternative 2, and runoff from that pile would only be contained using stormwater controls, waste rock would be used throughout the site for construction purposes, using selective handling criteria that are not yet defined. It is therefore not clear which fraction of the Revett Formation waste rock would be brought to the surface. Once more detailed information about the Revett and Prichard Formations waste rock is available, along with updated predictions of metal loading for tailings, these source terms would be incorporated into updated mass load calculations.

## Issue 2: Quality and Quantity of Surface and Ground Water Resources

***Ground Water Levels-Mine Area.*** The No Mine alternative would not change ground water levels. Disturbances at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

The agencies used a two-dimensional model to perform an analysis of the effects to mine area hydrology. A two-dimensional model was used because there were insufficient site data to support a three-dimensional model. The model required a number of simplifying assumptions described in section 3.10, *Ground Water Hydrology* section of Chapter 3.

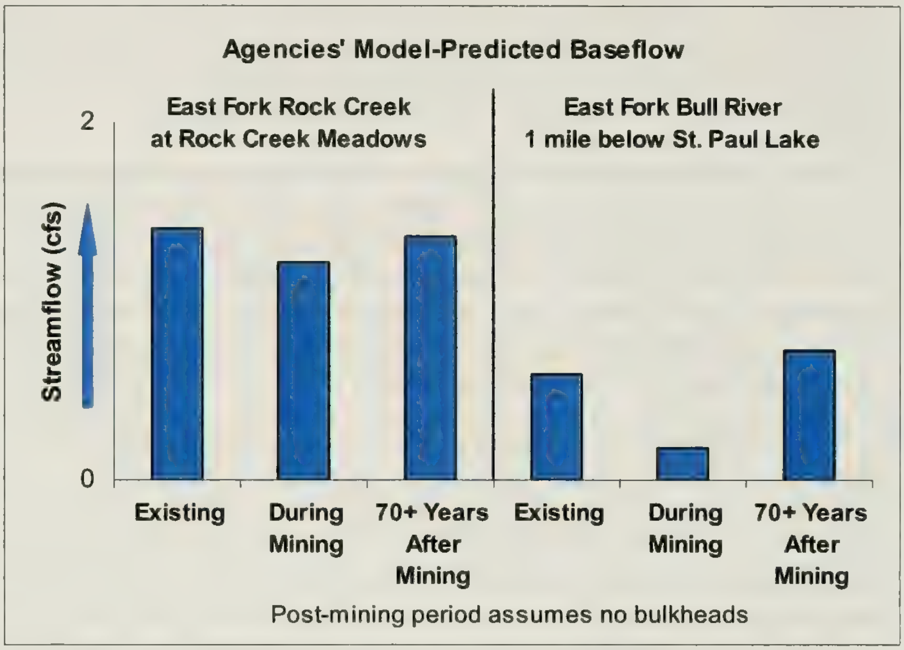
Based on the agencies' model, drawdown due to mine dewatering in Alternatives 2, 3, and 4 is predicted to extend about 2 miles from the mine void in all directions, but along the trend of the proposed adits, drawdown created by the mine void would merge with drawdown created by the adits. Given uncertainties associated with the model, the model cannot precisely predict the final configuration of the drawdown cone around the mine, but the model does provide an indication of the catchment area required to supply about 450 gallons per minute (gpm) to the mine and adits on a steady state basis. If steady state inflow to the mine were higher, a larger catchment would be required to supply that water at the calibrated infiltration rates and hydraulic conductivity. For example, if the steady state inflow were in the range of 800 gpm, as estimated by MMC, the catchment area would be about two times larger than predicted by the agencies' numerical ground water model (using the assumptions inherent in the calibrated version of the model).

An uncertainty in the final shape of the drawdown cone is the assumption in the agencies' numerical model that homogeneous conditions exist in the mine area. As a result of this assumption, the numerical model essentially distributes potential impacts from mine dewatering evenly in all directions. Actual site conditions may vary and ground water drawdown may be subject to some degree of heterogeneity, causing more drawdown along structural trends and less drawdown in other directions. Data are insufficient for the model to predict heterogeneous drawdown.

For those areas where the fractured bedrock water table is currently some depth below ground surface (for all areas above 5,600 feet elevation), ground water drawdown, as predicted by the agencies' numerical model, would not have a direct effect on surface water occurring above this elevation. Because surface and ground water above 5,600 feet elevation appear not to be hydraulically connected, ground water drawdown would not decrease flow to surface water (streams, springs and lakes) in areas above 5,600 feet elevation. Infiltration of precipitation is controlled by the nature of the surface material and overall hydraulic conductivity and, therefore, the infiltration rate would not change in these areas as a result of a lower water table. It is possible that random fractures exist above elevations of 5,600 feet that are saturated between the fractured bedrock water table and the shallow ground water flow path, hydraulically connecting the two ground water flow paths. If this condition were to exist, drawdown of the fractured bedrock water table by mine dewatering could reduce flow to unidentified springs or affect lake levels associated with this type of fracture, such as the Libby Lakes. However, there are no observations, data or numerical model results to indicate this condition exists.

For those areas where ground water is either at the surface or connected hydraulically to shallow ground water flow systems (below an elevation of about 5,600 feet), drawdown due to mine dewatering would decrease the volume of water available to the surface water system, such as springs, lakes, and creeks. The effects of ground water drawdown due to dewatering of the mine

can best be expressed by estimating changes to base flow in streams. Streams in the area flow at base flow for about 1 to 2 months between mid-July to early October; periods of base flow may also occur during November through March. The agencies' model predicts base flow would be reduced in East Fork Rock Creek, East Fork Bull River and Libby Creek in Alternatives 2, 3, and 4, and Ramsey Creek in Alternative 2.




The agencies estimate the area overlying the mine would require slightly more than 20 years to recover to steady state water level conditions after the mine void was filled with water. Based on an estimated inflow rate of about 450 gpm and estimated volume of the final mine void, the mine void would require about 50 years to refill. Ground water levels above the mine void are predicted to return to steady-state conditions about 70 years following mine closure and plugging of the portals. While water levels were recovering, the ground water flow direction in the region would be predominantly toward the mine void and adits and any change in base flow to streams would occur for much of this recovery period. Any change in ground water contribution to streams would decrease through the recovery period as the ground water head in the mine void increased and flow toward the mine void decreased. If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow.

***Ground Water Quality-Mine Area.*** The No Mine alternative would not change ground water quality in the mine area. During the mining period, the risk of measurable changes to ground water quality would be low in Alternatives 2, 3, and 4 because ground water would be moving toward the mine void and adits and then pumped to the surface for use in the ore processing. Any changes in water quality resulting from the mining process, such as an increase in the concentration of nitrogen compounds due to the use of explosives and ground water contact with oxidizing minerals in the ore body, would be removed from the mine void, used in mill processing, and eventually stored, treated, and discharged. Mine dewatering and the resulting drawdown of bedrock ground water could subtlely change water quality of various water bodies, such as Rock Lake, and unidentified springs and seeps. Assuming these water bodies receive water from both shallow and deep ground water sources, reducing the source of deeper ground water could reduce the introduction of certain minerals considered to be necessary for potential populations of organisms. If this water quality change were to occur, it may be difficult to detect or measure. The likelihood for this to occur would be minimized because MMC has committed to advanced

drilling and grouting fracture zones encountered in the mine that would reduce or eliminate the hydrologic impacts to any one area.

If ground water flowed from the filled mine void to the East Fork Bull River, attenuation and dilution of the dissolved metals as it moved about 3,000 feet vertically through fractures would likely reduce concentrations. The actual flow path may be longer than 3,000 feet. The fate and transport of dissolved metals within the flooded mine void cannot be predicted without significant uncertainty, particularly considering the relatively low surface water standards. MMC intends to construct a three dimensional ground water model during the mine development period when additional hydraulic data would be collected. A calibrated model could be used to evaluate the potential for the migration of dissolved metals from the mine void to surface water drainages such as the East Fork Bull River. If modeling were to indicate potential exceedances of surface water standards in nearby streams, various mitigation measures would have to be adopted prior to active mining. The agencies' numerical model indicates that during the post-mining period, there would be the potential for ground water to flow toward the mine void from the East Fork Rock Creek drainage (including Rock Lake). If this were to occur, there may be subtle changes in the water quality of Rock Lake, as described in the previous paragraph.

***Ground Water Levels-Tailings Impoundment and LAD Areas.*** The Little Cherry Creek Tailings Impoundment in Alternatives 2 and 4 is designed with an underdrain system to collect seepage from the tailings impoundment and divert intercepted water to a Seepage Collection Pond below the impoundment. A pumpback well system also would be necessary to collect tailings seepage that reached underlying ground water. Similar underdrain and pumpback well systems would be used at the Poorman Impoundment in Alternative 3. The tailings are expected to be placed in the impoundment with a high water content and as they consolidate, water would pool in low areas at the surface and would percolate downward. Most of the percolating water would be captured by the underdrain system, but some would seep into the underlying fractured bedrock aquifer. Tailings seepage not collected is expected to flow to ground water at a maximum rate of 25 gpm, slowly decreasing to 5 gpm after operations cease. The saturated zone beneath the impoundment would be able to accommodate the addition of 25 gpm from seepage and would respond with a rising water table (increasing the hydraulic gradient or slope of the water table) to convey the additional water from beneath the impoundment. Seepage from the tailings impoundment would enter the ground water system beneath the impoundment and be intercepted by a pumpback well system.

Four known springs and seeps along Little Cherry Creek would be covered by impoundment facilities. Flow from the springs above and below the tailings impoundment would remain relatively stable through the life of the mine.

In Alternatives 2, 3, and 4, mine and adit inflows greater than that needed in the mill or that could be stored in the tailings impoundment would be discharged at two LAD Areas between Ramsey and Poorman Creek. Ground water levels in the LAD Areas would rise, and increase the hydraulic gradient. The flow rate from springs between the two LAD Areas may increase. The increase in ground water levels would be a function of the application rate used at the LAD Areas. The agencies' analysis indicates the rates proposed by MMC in Alternative 2 would likely result in surface water runoff or increased spring and seep flow on the downhill flanks of the LAD Areas. In Alternatives 2, 3, and 4, the maximum application rate would be determined on a performance basis by monitoring both water quality and quantity changes to ground water. It is possible that monitoring would determine that the maximum application rate is higher or lower

than estimated by the agencies' analysis. The LAD application rates would be selected to ensure that ground water did not discharge to the surface as springs between the LAD Areas and downgradient streams.

***Ground Water Quality-Tailings Impoundment and LAD Areas.*** No ground water users have been identified in the analysis area. Private land immediately downgradient of the Little Cherry Creek Tailings Impoundment Site in Alternatives 2 and 4 is owned by MMC. Private land immediately downgradient of LAD Area 2 in all alternatives and downgradient of the Poorman Impoundment Site in Alternative 3 is not owned by MMC.

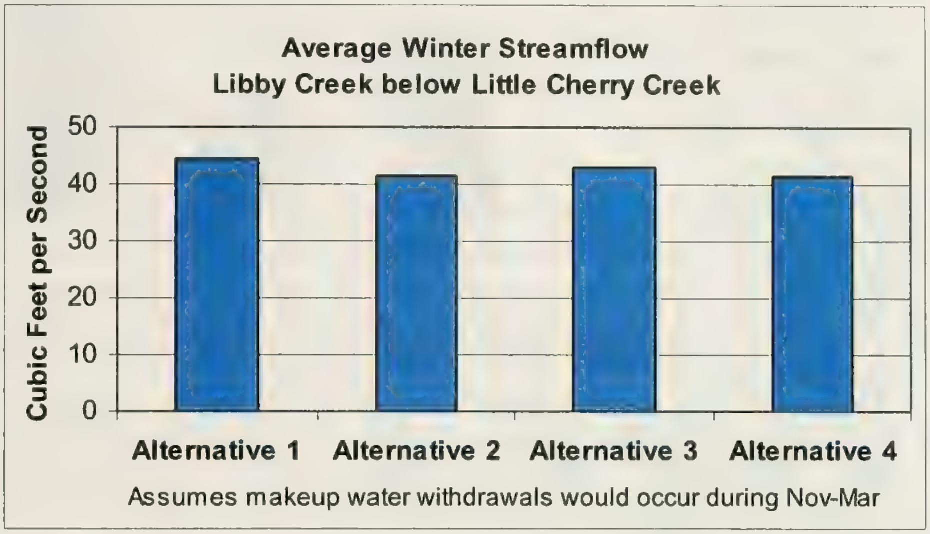
The BHES Order established numeric nondegradation limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface and ground water), as well as nitrate (ground water only), and total inorganic nitrogen (surface water only). These nondegradation limits apply to all surface water and ground water affected by the Montanore Project and remain in effect during the operational life of the mine and for as long thereafter as necessary.

In all alternatives, seepage not captured by the seepage collection system would mix with the underlying ground water. The existing ground water quality would be altered because the seepage water quality would have higher concentrations of nutrients, several metals, and total dissolved solids than existing water quality. Manganese concentrations are expected to be higher than the nondegradation limit set in a BHES Order in the mixing zone beneath the impoundment. Concentrations of all other parameters are predicted to be below ground water standards or BHES Order nondegradation limits. Concentrations of total dissolved solids, antimony, and manganese in all alternatives, nitrate in Alternative 2, and zinc in Alternatives 3 and 4 beneath the LAD Areas are predicted to exceed ground water standards or BHES Order nondegradation limits in one or more phases of mining. During the MPDES permitting process, the DEQ would determine if a mixing zone downgradient of the tailings impoundment or LAD Areas would be allowed and, if so, would determine the mixing zone's size, configuration, and location. MMC requested a source-specific mixing zone for the tailings impoundment. The DEQ would determine if a source-specific mixing zone should be granted in accordance with ARM 17.30.518. If DEQ granted a mixing zone, water quality changes may occur and certain water quality standards may be exceeded within the mixing zone. The DEQ also would determine where compliance with applicable standards would be measured.

Ground water beneath the LAD Areas would have higher concentrations of total dissolved solids, nutrients, and metals as long as the seepage collection facilities at the tailings impoundment operates and tailings water is discharged at the LAD Areas. The length of time these closure activities would occur is not known, but may be decades or more.

***Surface Water Flows-During Mining.*** The analysis area is drained on the east by Libby Creek and its tributaries: Ramsey Creek, Poorman Creek, and Little Cherry Creek. Libby Creek flows north from the analysis area to its confluence with the Kootenai River near Libby. The analysis area is drained on the west by the East Fork Rock Creek and East Fork Bull River. The East Fork Rock Creek flows southwest into the Clark Fork River downstream of Noxon Reservoir. The East Fork Bull River flows northwest into the Bull River. The transmission line corridor area is drained by the Fisher River and its tributaries: Hunter Creek, Sedlak Creek, Miller and North Fork Miller creeks, Standard Creek, and West Fisher Creek; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the analysis area. Snowmelt, rainfall, and ground water

discharge are the main sources of supply to streams, lakes, and ponds in the analysis area. High surface water flows typically occur during spring snowmelt, between April and July. Low flows typically occur during August and September.

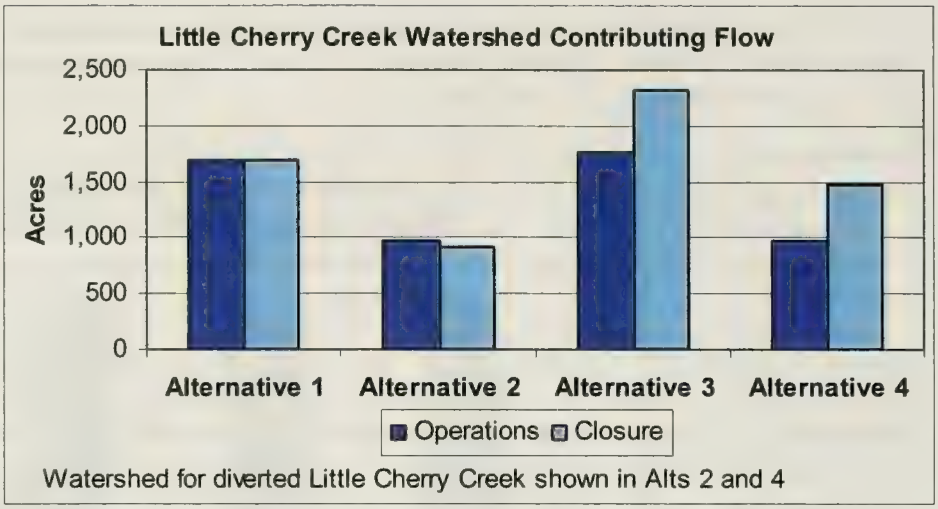



Alternative 1 would not affect surface water flow. All mine alternatives would reduce the flow in area streams during mining. The anticipated changes to base flow have been discussed in the preceding ground water section. Mine facilities would alter flow in Libby Creek and its tributaries through diversions, discharges, and make-up water wells. Changes in flow would not be measurable if withdrawals occur during high flow periods between April and July. In Alternatives 2 and 4, if withdrawals occur during November through March, average flow in Libby Creek below Little Cherry Creek during November through March would be reduced by 6 percent. Average flow in Alternative 3 would be reduced by 4 percent. Percent change in flow would be greater during lower flow periods and less in higher flow periods.

During operations in Alternatives 2 and 4, 13 percent of the Little Cherry Creek watershed would continue to contribute flow to the former Little Cherry Creek channel downstream of the Seepage Collection Dam; the estimated $7Q_{10}$ flow would be 0.01 cubic feet per second (cfs) and the estimated average annual flow would be 0.77 cfs. By intercepting ground water, the pumpback well system below the impoundment may further reduce base flow. The flow in Channel A would be about 60 percent of the flow of the original Little Cherry Creek.

In Alternative 3, any flow within the watershed above the impoundment would be routed to Poorman or Little Cherry creeks. Water from a 146-acre watershed above the Poorman Tailings Impoundment would be diverted to Poorman Creek, increasing the watershed of Poorman Creek by 4 percent. Water from an 80-acre watershed above the Poorman Tailings Impoundment would be diverted to Little Cherry Creek, an increase of 8 percent in the Little Cherry Creek watershed. The larger watershed would increase runoff during stormwater runoff and would not affect base flows.

***Surface Water Flows-Post Mining.*** In Alternative 2, post-mining flows in Libby Creek above Bear Creek would be slightly reduced because surface water runoff from the impoundment would be routed to Bear Creek. The Bear Creek watershed area where runoff would meet the creek would increase by 560 acres, potentially increasing the flow in Bear Creek by 5 percent or less. The larger watershed would increase runoff during stormwater runoff and would not affect base flows.




The Little Cherry Creek Diversion Channel would remain in place, routing surface water runoff in the upper Little Cherry Creek watershed in the Diversion Channel to Libby Creek. After removal of the Seepage Collection Dam, runoff from the South Saddle Dam and the south Main Dam abutment would flow to the Diversion Channel. Runoff from the Main Dam face would flow to the former Little Cherry Creek drainage. Post-mining, 26 percent of the Little Cherry Creek watershed area would continue to contribute flow to former Little Cherry Creek downstream of the Seepage Collection Dam; the estimated $7Q_{10}$ flow of the creek would be about 0.02 cfs and the estimated average annual flow of the creek would be about 1.5 cfs. Average flows in the diverted Little Cherry Creek (Channel A) would be about 55 percent of the flow in the original Little Cherry Creek. For a short segment of Libby Creek between Channel A and Bear Creek, the change in the watershed areas that would contribute water to Libby Creek would be 3 percent or less. Below Bear Creek, flows in Libby Creek would return to pre-mine conditions, less any reduced base flows (predicted by the agencies to be immeasurable).

In Alternative 3, runoff from the reclaimed Poorman Tailings Impoundment surface would be routed toward Little Cherry Creek. The watershed area of Little Cherry Creek would increase by 644 acres, an increase of 38 percent. Average annual flows in Little Cherry Creek would increase by similar percentages. The larger watershed would increase runoff during stormwater runoff and would not affect base flows. Post-mining, changes in the watershed areas contributing water to Poorman and Libby Creek would be 3 percent or less. Below Little Cherry Creek, flows in Libby Creek would return to pre-mine conditions, less any reduced base flows (predicted by the agencies to be immeasurable).

After mining in Alternative 4, runoff from the reclaimed tailings impoundment surface would be routed via the permanent Diversion Channel and Channel A to Libby Creek. After the Seepage Collection Dam was removed, runoff from the South Saddle Dam and the south Main Dam abutment also would flow to the Diversion Channel. Consequently, the watershed of Channel A would increase by about 500 acres post-mining, compared to operational conditions. Average annual flow in the diverted Little Cherry Creek would be about five times the existing flow in Channel A, but about 10 percent less than the current flow of Little Cherry Creek. The larger watershed would increase runoff during stormwater runoff and would not affect base flows.

Runoff from the Main Dam would flow to the former Little Cherry Creek channel. Post-mining, the watershed area contributing water to the former Little Cherry Creek channel would decrease by 85 percent directly below the tailings impoundment and by 74 percent at the confluence of Little Cherry and Libby creeks. Changes in the watershed areas contributing flow to Bear and

Libby creeks would be 5 percent or less. Below Bear Creek, flows in Libby Creek would return to pre-mine conditions, less any reduced base flows (predicted by the agencies to be immeasurable). Bear Creek streamflow would not be affected.

***Surface Water Quality.*** Water quality in analysis area streams is generally good. Total suspended solids, TDS, major ions, and nutrient concentrations are all low, frequently at or below analytical detection limits. Generally, TDS, major ion, and some minor ion concentrations (such as iron) increase downstream in Libby Creek and its tributaries. Some elevated metal concentrations can be attributed to local geology (mineralization).

In the analysis area, three stream segments are listed on Montana's 303(d) list of impaired streams. Libby Creek from 1 mile above Howard Creek to the U.S. 2 Bridge is listed. Use as a drinking water supply is not supported as a beneficial use, and aquatic life support and cold-water fishery uses are only partially supported for this reach. The Fisher River from the confluence of the Silver Butte Fisher River and the Pleasant Valley Fisher River to the confluence with the Kootenai River is also listed, with aquatic life support and cold-water fishery uses only partially supported. Rock Creek from the headwaters to the mouth below Noxon Dam is also listed, with aquatic life support and cold-water fishery uses only partially supported. Total Maximum Daily Loads (TMDLs) for the impairments have not been prepared by the DEQ.

Alternative 1 would not affect surface water quality. Alternatives 2, 3, and 4 would affect stream quality by changing dissolved solids, nutrients, and metals concentrations. Changes would occur in part due to reductions in streamflow contributions from deeper ground water, which contributes more total dissolved solids to streams than shallower sources of water. Water quality changes also would occur due to wastewater discharges at the LAD Areas. The agencies' analysis indicated that concentrations of total inorganic nitrogen and manganese in Ramsey and Poorman creeks may exceed BHES Order limits in all alternatives during one or more phases of mining. Antimony and zinc concentrations may also exceed surface water standards or BHES Order limits. With proposed treatment, instream concentrations following discharges would be at or below concentrations set in the BHES Order, surface water quality standards, or ambient concentrations. If land application of excess water would result in water quality exceedances, MMC would treat the water at the Libby Adit Water Treatment Plant prior to land application. If needed, an additional water treatment facility may be required. Water discharged from the treatment facilities to a nearby stream could not cause an exceedance in a BHES Order nondegradation limit or water quality standard for all parameters. Concentrations of total inorganic nitrogen in streams affected by the Montanore Project may increase to 1 mg/L, copper to 0.003 mg/L, and manganese to 0.05 mg/L, the limits set in the BHES Order.

***Surface Water Quality-Sediment.*** In Alternatives B, C, and D, areas cleared of vegetation would be susceptible to erosive forces and soil loss. Loss of soil also would occur from the removal and storage of soils during mine operations and from erosion of exposed soils during reclamation and stabilization. Soil erosion caused by wind or water likely would occur during all phases of the project. Initial erosion rates would be moderate to high due to soil exposure, slope steepness, and precipitation patterns.

In Alternative 2, MMC proposed a 10,800-foot Little Cherry Creek Diversion Channel around the tailings impoundment that would flow into Libby Creek. The Diversion Channel would consist of two main sections: an upper engineered channel and two existing natural drainage channels tributary to Libby Creek. The lower channels are not large enough to handle the expected flow

volumes; these tributaries would undergo channel adjustments until they stabilized. These adjustments would include bank erosion, channel scouring, and sloughing of bank material, which would contribute sediment to Libby Creek. MMC would construct some bioengineering and structural features in the two unnamed tributary channels to reduce flow velocities, minimize erosion in the unnamed tributaries, minimize sedimentation to Libby Creek, and create fish habitat. In addition, MMC would evaluate potential locations for creating wetlands and ponds in low gradient areas to capture and retain most of the sediment generated from the unnamed tributaries and minimize sedimentation to Libby Creek. Bank erosion in the unnamed tributaries and possibly sedimentation to Libby Creek would continue until the tributaries adjusted to the increased flow volumes. If substantial erosion occurs once the diversion channel was operational, additional erosion control structures would be constructed as needed.

One of the possible fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If implemented, this project would minimize the contribution of additional sediment to the Libby Creek watershed.

Alternative 4 would have similar effects as Alternative 2. The Diversion Channel in Alternative 4 would flow into a constructed channel that would be designed to be geomorphologically stable and to handle the 2-year flow event. A floodplain would be constructed along the channel to allow passage of the 100-year flow. Natural and biodegradable materials and vegetation would be used along stream banks and on the floodplain to minimize erosion, stabilize the stream channel and floodplain, and minimize sedimentation to the lower channel and Libby Creek. Following reclamation of the impoundment, the constructed channel would undergo an additional period of channel adjustment when runoff from the impoundment surface was directed to the Diversion Channel. The increase in flow would be about 50 percent higher than during operations, and would lead to new channel adjustments. This would likely cause short-term increases in sedimentation in the lower channel and Libby Creek.

Alternative 3 would result in less sedimentation of analysis area streams than Alternatives 2 or 4 because diversion of a perennial stream would not be needed. Effects of vegetation clearing for mine facilities and access roads would be similar to Alternatives 2 and 4.

In Alternatives 3 and 4, MMC would initially identify existing sediment sources in Libby Creek particularly near the plant site and then off-site in Ramsey, Poorman, or upper Libby creeks. After existing sediment sources were identified, MMC would develop sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sources. This mitigation would minimize the contribution of additional sediment to the Libby Creek watershed.

### Issue 3: Fish and Other Aquatic Life and Their Habitats

Aquatic habitat in most analysis area streams is good to excellent. The riparian habitat condition in Libby Creek between Poorman Creek and Little Cherry Creek is fair, reflecting the physical effects of abandoned placer mining operations. Overall, the analysis area streams score high on measures such as bank cover and stability, while measures of pool quality and quantity are typically lower, resulting in an overall reduction in stream reach scores for habitat condition. Most streams have a moderate susceptibility to habitat degradation.

Analysis area streams provide habitat for the federally listed bull trout, and Forest sensitive species westslope cutthroat trout and interior redband trout. Mixed redband rainbow, coastal rainbow, and westslope cutthroat/rainbow hybrids, Yellowstone cutthroat, brook trout, torrent and slimy sculpin, mountain whitefish, longnose dace, and largescale suckers are also in the drainages. In the mine analysis area, designated critical bull trout habitat is found in four segments of Rock Creek and three segments of Libby Creek. Bull trout are found in most streams, except where barriers have prevented their passage, such as Little Cherry Creek and Miller Creek. No pure westslope cutthroat trout populations have been found to inhabit stream reaches within the Libby Creek watershed. The hybrid trout populations in Ramsey Creek, Bear Creek, Little Cherry Creek, and segments of Libby Creek downstream of the mine area include coastal rainbow/westslope cutthroat and redband/westslope cutthroat trout hybrids. The East Fork Bull River has a pure westslope cutthroat trout population, and both pure and hybrid populations are found in East Fork Rock Creek. Miller Creek has a pure westslope cutthroat trout population. Pure populations of interior redband trout are found in Libby, Bear, Little Cherry Creek, Poorman, and Ramsey creeks and in the Fisher River.

In Alternative 1, No Mine, the Montanore Project would not be developed and existing disturbances would continue to affect aquatic habitats. Past activities, particularly timber harvest and road construction, and ongoing current activities have occurred in RHCAs, and would continue to decrease the quality of aquatic habitats. Productivity of fish and other aquatic life in analysis area streams would continue to be limited by past natural and human-caused adverse habitat changes, by naturally low nutrient concentrations, and by natural habitat limitations from periodic floods and other climate and geology influences.

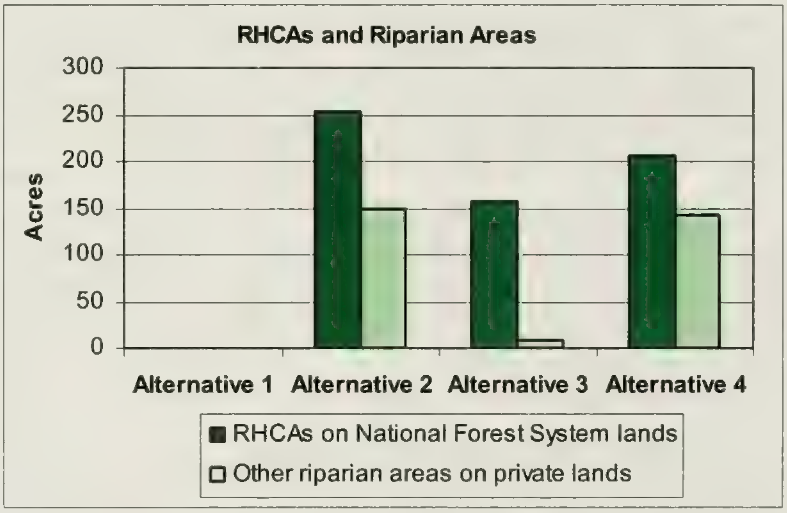
Bull trout populations would continue to be marginal and their habitat would continue to be in need of restoration work. Bull trout populations would be susceptible to decline or disappearance due to hybridization with the introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances. Redband trout and westslope cutthroat trout also would continue to be subject to population declines, mainly due to the threat of hybridization from past introductions of non-native salmonids.

***Sediment.*** Periodic short-term increases in the amount of sediment would occur in streams in the Libby Creek watershed in Alternatives 2, 3, and 4. An increase in the amount of sediment in streams can alter stream habitat by decreasing pool depth, affecting substrate composition, filling in interstitial spaces used by juvenile fish and invertebrates, and increasing substrate embeddedness. These habitat alterations in turn can adversely affect the invertebrate and fish populations within the streams. The abundance of fine sediment does not currently appear to be a limiting factor to trout populations within most stream reaches within the Libby Creek watershed. Competition with brook trout and other trout species is one of the larger threats to bull trout in the Libby Creek drainage, and there are indications that brook trout are more successful than native trout in degraded areas, including areas where fine sediment levels are increased. Slight increases in sediment in Libby Creek may give the brook trout present in this stream a competitive advantage over bull trout. The introduction of small amounts of additional small gravels and fine sediment from construction or operation of the mine would likely have few effects on macroinvertebrate and fish populations, and these effects would be short-term, as annual snowmelt runoff would flush most accumulated fine sediments downstream. The optional mitigation in Alternative 2 and the required mitigation in Alternatives 3 and 4 includes an inventory of existing sediment sources in the Libby Creek watershed and the implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution

from the identified sources. Alternatives 3 and 4 also would include the installation of grade control structures in a reach of Libby Creek between Little Cherry Creek and Bear Creek to decrease the width to depth ratio and increase the frequency of deep pool habitat. Grade control structures would improve bedload transport, decrease width to depth ratios, and reduce fine sediment accumulation.

***Riparian Habitat Conservation Areas.*** RHCAs are protection zones adjacent to streams, wetlands, and landslide-prone areas. The KFP has standards and guidelines for managing activities that potentially affect conditions within the RHCAs, and for activities in areas outside RHCAs that potentially degrade RHCAs. These standards apply only to riparian areas on National Forest System lands. Similar riparian areas are found on private land. All riparian areas are covered by Montana's Streamside Management Zone law.

Alternatives 2, 3, and 4 would require construction of roads, waste disposal facilities, and other facilities in RHCAs. Protection of RHCAs was a key criterion in the alternatives analysis and development of alternatives. The lead agencies did not identify a practicable alternative that would avoid locating mine facilities in RHCAs. Alternative 2 would affect 253 acres of RHCAs and 148 acres of other riparian areas on private lands, primarily in the Little Cherry Creek Impoundment Site and the Ramsey Plant Site. Little Cherry Creek and Ramsey Creek are both fish-bearing streams. Effects of Alternatives 3 and 4 would be less than Alternative 2. Alternative 3 would affect 158 acres of RHCAs and 9 acres of other riparian areas on private lands. The RHCAs in the Poorman Tailings Impoundment Site in Alternative 3 are not adjacent to fish-bearing streams. The Libby Plant Site in Alternatives 3 and 4 would not affect RHCAs. The disturbance area at the Little Cherry Creek Impoundment Site would be changed in Alternative 4 to avoid RHCAs. Alternative 4 would affect 206 acres of RHCAs and 143 acres of other riparian areas on private lands, primarily in the Little Cherry Creek Impoundment Site. In Alternatives 3 and 4, MMC would develop and implement a final Road Management Plan to reduce effects on RHCAs. The plan would describe for all new and reconstructed roads criteria that govern road operation, maintenance, and management; requirements of pre-, during-, and post-storm inspection and maintenance; regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives; implementation and effectiveness monitoring plans for road stability, drainage, and erosion control; and mitigation plans for road failures.




***Water Quantity.*** During operations, Alternatives 2, 3, and 4 would alter flow in Libby Creek and its tributaries through diversions, discharges and make-up water wells. Changes in flow would not be measurable if withdrawals occur during high flow periods between April and July. If withdrawals occur during November through March, average flow in Libby Creek below Little Cherry Creek would be reduced by 4 to 6 percent, depending on the amount of mine inflows and

the alternative. Percent change in flow would be greater during lower flow periods and less in higher flow periods. The inherent difficulties in accurately measuring low flows and the natural variability in low winter flow make the determination of impacts to fish habitat very difficult, but the decrease in flow would decrease available habitat. Except for Little Cherry Creek, changes in flow in Libby Creek tributaries would not affect aquatic life. Post-closure, a slight decrease in Libby Creek streamflow may decrease available habitat slightly during low flow periods, adversely affecting salmonids in the stream. During the post-mining period, water would continue to be released from tailings consolidation and discharged at the LAD Areas. Discharges at the LAD Areas would continue to increase Libby Creek streamflows. This additional flow in Libby Creek below the LAD Areas would partially offset the reduction in base flow when discharges occurred. Aquatic habitat would not be affected as long as discharges continue. The installation of 25 structures in Libby Creek in Alternatives 3 and 4 would offset the reduction of fish habitat in the creek.

In Alternatives 2 and 4, Little Cherry Creek would be diverted permanently around the tailings impoundment, resulting in a loss of 13,000 feet of aquatic habitat in the existing Little Cherry Creek. The diverted Little Cherry Creek would be shorter (9,500 feet) and consequently steeper. In Alternative 2, average flow in the diverted Little Cherry Creek during operations would be about 60 percent of the average flow in the existing Little Cherry Creek, and about 55 percent after closure. Alternative 4 would have similar effects on flow during operations. After closure, flow in the diverted Little Cherry Creek in Alternative 4 would be about 90 percent of the average flow in the existing Little Cherry Creek because flow from the impoundment surface would flow to the diverted creek and not to Bear Creek. The agencies' analysis assumed the engineered diversion channel would not provide any fish habitat, while the two channels would eventually provide marginal fish habitat for either redband trout or bull trout. Effects on the redband trout population in Little Cherry Creek would be minimal but would persist long-term.

In both alternatives, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. While MMC would remove redband trout safely from the section of Little Cherry Creek to be diverted and then place them in the new diversion drainage, some fish mortality due to handling stress may occur from removal, storage, or replacement methods. MMC would design the Little Cherry Creek Diversion Channel, to the extent practicable, for fish habitat and passage. MMC's survey of the unnamed tributary to Libby Creek that would receive diverted water (Channel A) shows that most of the drainage would develop habitat comparable to Little Cherry Creek.

During operations, Alternatives 2, 3, and 4 would reduce flow in East Fork Rock Creek and East Fork Bull River. These flow changes would affect aquatic habitat in the East Fork Rock Creek between Rock Lake and Rock Creek Meadows, a distance of about 0.75 mile. Trout habitat may be reduced during low flows from August to April. This habitat loss would be detrimental to the resident westslope cutthroat trout populations in the higher elevations of East Fork Rock Creek. Changes in flow from Rock Creek Meadows downstream would not likely be measurable, but would contribute to the dewatered sections and lower habitat in lower Rock Creek. Changes in flow in the East Fork Bull River below St. Paul Lake during mine operations may be difficult to separate from the natural variability of low flows. Flow reductions in the upper river may result in habitat loss and adversely affect the bull trout population that spawns in East Fork Bull River.

For fisheries mitigation in Alternatives 3 and 4. MMC would complete a comprehensive aquatic habitat assessment from the confluence of the East Fork Bull River and Snake Creek up to the

extent of fish habitat in the East Fork Bull River (~1.3 miles past the CMW boundary). Following completion of the habitat inventory, MMC would construct instream structures forming pools and deep water habitat (>1.5 feet depth) from Snake Creek to a location 0.5 mile into the CMW. Trail #935 leading to Rock Lake would be converted from a motorized trail to a non-motorized trail, reducing its sediment contribution and increasing riparian habitat along the trail. These measures would improve aquatic habitat in Rock Creek and the East Fork Bull River.

***Water Quality.*** Alternatives 2, 3, and 4 would increase concentrations of nutrients, such as nitrates, and some metals in Ramsey, Poorman, and Libby creeks. Presently, low nutrient concentrations contribute to the naturally limited aquatic productivity. If the total organic nitrogen concentration in Libby Creek surface water increases to the allowable concentration of 1 mg/L set in the BHES Order, this would be an increase over existing concentrations in Libby Creek by a factor of 2 to 5. Increases in total organic nitrogen concentrations to 1 mg/L would be more likely near the discharge areas (LAD Areas and the Libby Adit), as total organic nitrogen concentrations would decrease downstream due to dilution with higher streamflows. The total organic nitrogen concentration increase may cause an increase in algal growth in Libby Creek, but algal growth would more likely be limited by factors other than nitrogen, such as phosphorus, temperature, flow, and light. Although the projected total organic nitrogen concentration would be greater than existing conditions, the ammonia component of total organic nitrogen would remain well below the applicable standard.

The BHES Order would allow an increase of copper up to 0.003 mg/L in all project waters. About half the surface water samples from Libby Creek had copper concentrations below the detection limit, 15 percent were greater than 0.003 mg/L, and the remaining samples were 0.003 mg/L or less. The enrichment for copper may increase up to a factor of 3 or more, depending on the actual copper concentration of samples with below detection limit values, and the actual instream copper concentration after discharge of wastewater. Potential effects to aquatic life from an increase in copper concentrations are difficult to determine given the uncertainty with the protectiveness of the hardness-modified copper standard and existing copper concentrations. Measured copper concentrations are either at or near minimum laboratory detection limits, creating some uncertainty with the projected change in concentrations from existing conditions.

## Issue 4: Scenic Quality

The existing scenery from Key Observation Points (KOPs) would not change in the No Mine Alternative. The existing Libby Adit Site would remain, and would be visible only from one KOP in a montane forest at a National Forest System road #231 pullout. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

Construction of all proposed mine facilities would alter the scenic integrity from KOPs. The relatively large size of the tailings impoundment in Alternatives 2, 3, and 4 in all views would create noticeable contrasts in landscape character and significant alterations in scenic integrity. The tailings impoundment in Alternatives 2 and 4 would cover Little Cherry Creek, altering the area's scenic integrity. In addition, there would be the short-term effects from the presence of fugitive dust from construction activities, night lighting for construction operations, and vehicle traffic. The agencies' mitigations in Alternatives 3 and 4 would reduce the visual contrasts at most facility locations. Long-term effects on scenery would be loss of vegetation and landform changes at all mine facilities. Following mine closure, landscape reclamation at all mine facilities, except

the tailings impoundment, would create areas similar in appearance to abandoned roads and timber harvest areas. The tailings impoundment would have physical characteristics significantly contrasting with the surrounding landscape. The scenic integrity and landscape character changes at the impoundment site would be noticeable indefinitely.

In Alternatives 2, 3, and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of LAD Areas 1 and 2, and portions of the plant site and tailings impoundment currently not in MA 31. In addition, a proposed road and facility corridor that would cross MA 13 would be reallocated to MA 31. MA 31 has a Visual Quality Objective (VQO) of Maximum Modification. All mine facilities would be in compliance with a VQO of Maximum Modification.

## Issue 5: Threatened and Endangered Wildlife Species

The mine area provides habitat for three threatened and endangered wildlife species: the grizzly bear, the gray wolf, and the Canada lynx. This summary provides a brief discussion of effects on threatened and endangered wildlife species; the reader is referred to section 3.24.5, *Threatened, Endangered, and Proposed Species* in the *Wildlife Resources* of Chapter 3 for a complete analysis of effects on threatened and endangered wildlife species. Bull trout, which is also a threatened and endangered species, was discussed previously under Issue 3, Effects on Fish and Other Aquatic Life and Their Habitats.

***Grizzly Bear.*** The agencies used five criteria to assess effects on the grizzly bear: percent core habitat, percent open motorized route density (OMRD), percent total motorized route density, linear open road density, and percent habitat effectiveness (HE). Because percent OMRD, percent total motorized route density, and linear open road density are all a function of open roads, only percent OMRD is discussed in this Summary.

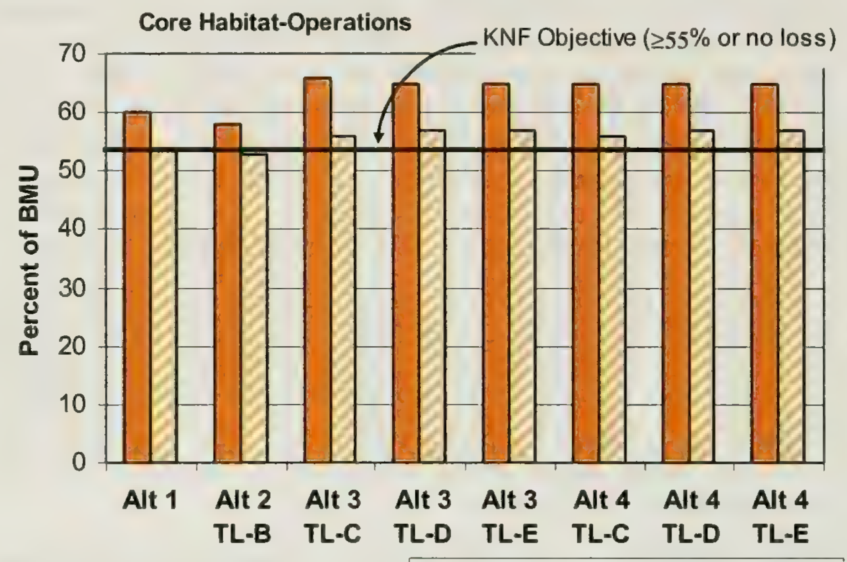
These criteria are evaluated within a planning area called a Bear Management Unit, or BMU. A BMU is an area of land containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly. The project would affect habitat in two BMUs: BMU 5, St. Paul, and BMU 6, Wanless.

Because of the complexity of the analysis, the agencies did not complete separate analyses for criteria dependent on open roads for the mine alternatives and transmission line alternatives. Instead, the agencies analyzed combinations of mine and transmission line alternatives, which would compose a complete project. Alternative 2-TL B is MMC's proposed mine (Alternative 2) and its proposed North Miller Creek transmission line alternative (Alternative B). Six other mine and transmission line alternative combinations were analyzed: mine Alternative 3 with the three agencies' transmission line alternatives (Alternatives C, D, and E); and mine Alternative 4 with the three agencies' transmission line alternatives (Alternatives C, D, and E). These combinations are discussed in the following sections on effects to grizzly bear.

***Percent Core Habitat.*** A core area or core habitat is an area of high quality grizzly bear habitat within a BMU that is greater than or equal to 0.31 mile from any road (open or restricted), or motorized trail open during the active bear season. Core habitat may contain restricted roads, but such roads must be effectively closed with devices, including but not limited to, earthen berms, barriers, or vegetative growth. Federal agencies will work toward attaining a core area of at least 55 percent in the BMU and will allow no loss of core areas on federally-owned land within the BMU.

Alternative 2 TL-B would reduce core habitat from 60 percent in BMU 5 to 58 percent during construction and operations, and to 59 percent at closure. Access changes proposed by the KNF would create core habitat in the agencies' alternatives, and core habitat in the other six alternative combinations would increase to 65 or 66 percent during construction, operations, and closure.

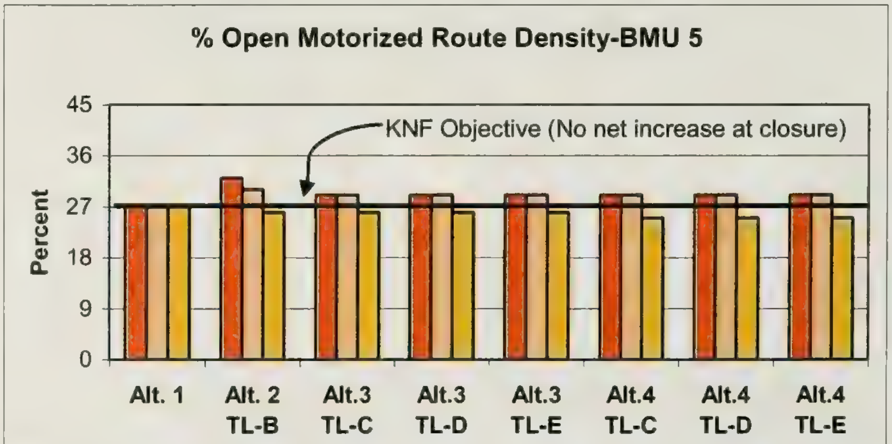
Core habitat in BMU 6 (54 percent) currently is below the goal of 55 percent and would remain so in Alternative 1. During construction, operations, and closure, Alternative 2-TL B would reduce core habitat from 54 percent in BMU 6 to 53 percent. Core would increase through access changes to between 55 and 57 percent in all other alternative combinations during all three periods.




Effects shown do not include potential core habitat created by access changes on acquired lands

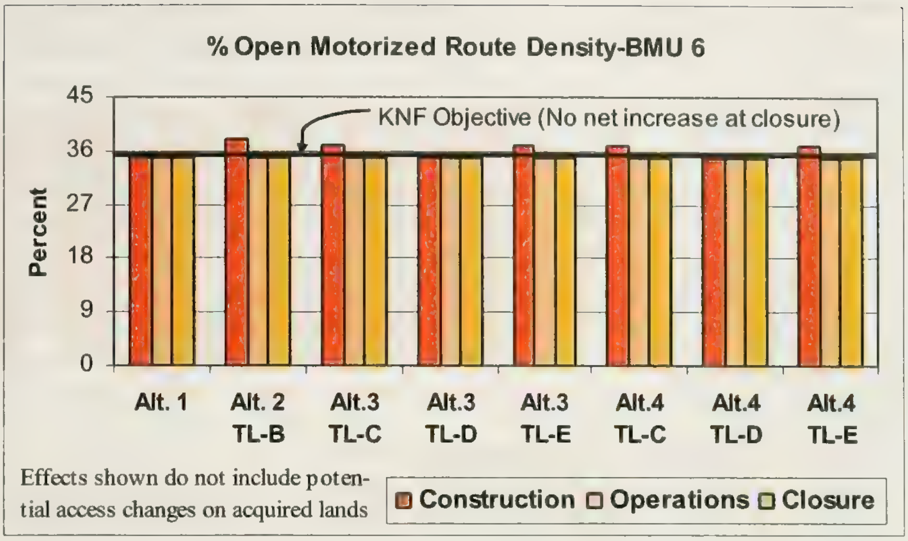
For all combined mine-transmission line alternatives, impacts to core habitat would be reduced through MMC's or the agencies' proposed land acquisition programs. Parcels that might otherwise be developed in a manner inconsistent with bear needs would be acquired by MMC, conveyed to the KNF, and managed for grizzly bear use in perpetuity. The agencies anticipate additional land acquisition beyond that proposed by MMC would be necessary to mitigate all effects. The agencies' proposed land acquisition program has the potential to increase core habitat through access changes on acquired land. The potential increase in core habitat from acquired lands is not shown in the above chart.

***Open Motorized Route Density.*** OMRD is a measure of the density of roads or trails in a BMU that are open for motorized access. Best science indicates that OMRD greater than 1 mi/mi$^2$ should not exceed




Effects shown do not include potential access changes on acquired lands

33 percent of a BMU. Federal agencies will allow no net increase in OMRD on federally-owned land within the BMU.




All combined alternatives would increase OMRD in BMU 5 during construction and operations. OMRD in BMU 5 would be better than existing densities after closure for all Alternatives. Compliance with OMRD direction is based on densities at mine closure.

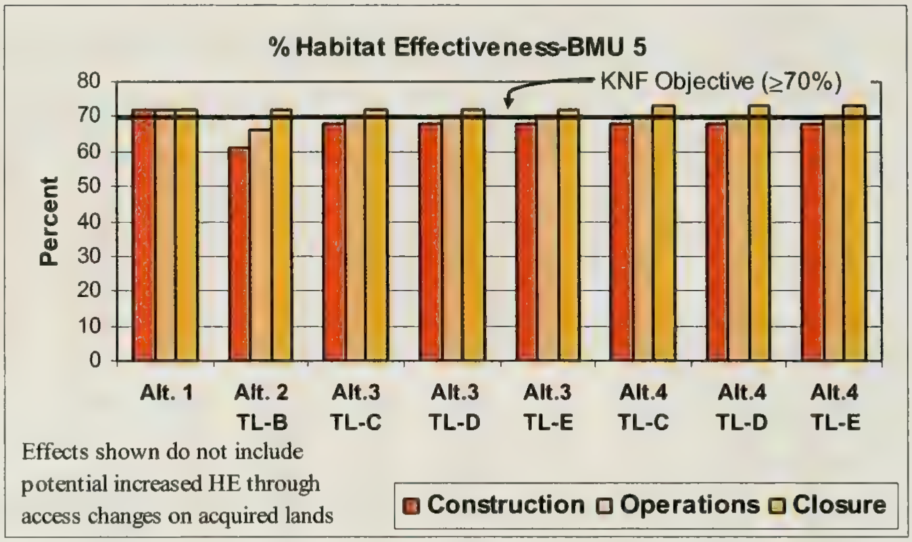
OMRD in BMU 6 during construction would be worse than existing densities in all combined alternatives, and would return to existing densities during operations and after closure for all combined alternatives. The agencies' proposed land acquisition program has the potential to improve OMRD in BMUs 5 and 6 through access changes on acquired land.

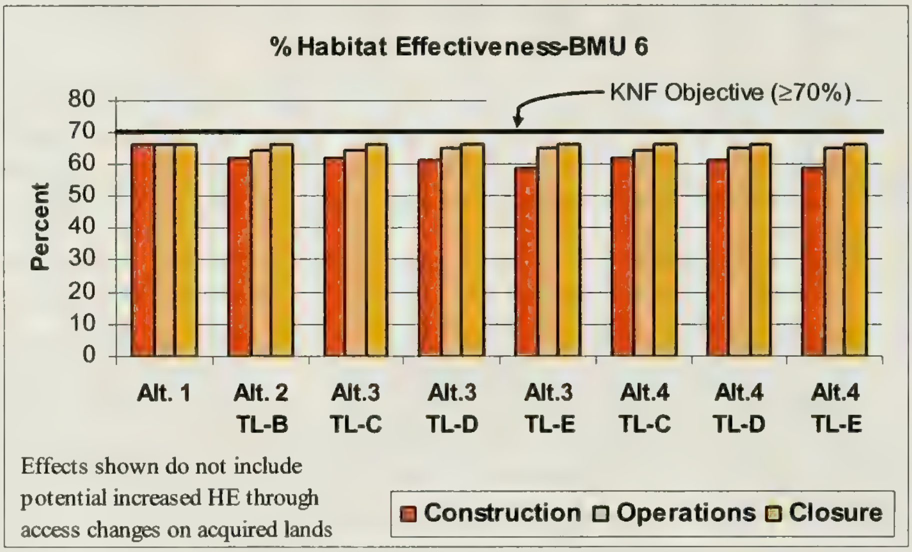
***Habitat Effectiveness.*** HE is the amount of secure grizzly bear habitat (habitat at least 0.25 mile from open roads, developments, and high levels of human activity during the active bear year) remaining within a BMU after affected areas and Management Situation 3 lands (where grizzly bear presence is possible but infrequent) are subtracted from the total habitat in the BMU. Management Situation 3 lands are areas of high human use where grizzly bear presence is possible but infrequent and where conflict minimization is a high priority management consideration. Grizzly bear presence and factors contributing to their presence will be actively discouraged.

HE is calculated for all lands within an affected BMU, regardless of ownership. In calculating HE, the extent of a zone of influence depends on the type of activity. HE should be maintained equal to or greater than 70 percent of the BMU.

For all combined mine-transmission line alternatives, impacts to HE during all three phases would be reduced through MMC's (Alternatives 2 and B) and the agencies' proposed land acquisition programs (all other alternatives). Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The agencies anticipate additional land acquisition beyond that proposed by MMC would be necessary to mitigate all effects. The agencies' proposed land acquisition program would likely result in a net gain in grizzly bear habitat effectiveness, through access changes and elimination of sources of grizzly bear disturbance, where possible. Potential increased HE through land acquisition is not shown in the charts or discussed in the following paragraphs.

Alternative 2 TL-B would have greater effect to HE in BMU 5 than the other alternatives, reducing HE to 61 percent during construction and 66 percent during operations, primarily because effects of the Ramsey Plant Site would occur in a separate drainage than other mine facilities. The combined agencies' alternatives would have the same effects on HE in BMU 5, reducing HE to 68 percent during construction and 70 percent during operations. At closure, HE would be 72 to 73 percent in all combined alternatives.




In BMU 6, Alternatives 3 TL-E and 4 TL-E would reduce HE to 59 percent during construction, due to a larger extent of helicopter activity. The other combined alternatives would reduce HE in BMU 6 to 61 or 62 percent during construction. During operations, all alternatives would be similar, reducing HE to 64 or 65 percent. At closure, HE would return to 66 percent in all combined alternatives.

***Gray Wolf.*** The agencies evaluated impacts to the gray wolf based on three criteria: year-round prey base, suitable denning and rendezvous sites, and sufficient space with minimal exposure to humans. The condition of the prey base is evaluated based on KFP management standards for white-tailed deer and elk. Sufficient space with minimal exposure to humans is generally measured by maintaining ORD standards required by the KFP as well as maintaining any security habitat recommended in the big game habitat recommendations. The Fishtrap pack is the only known wolf pack potentially affected by the Montanore Project. At least two wolves use portions

of the analysis area on a regular basis. No wolf packs or den sites have been confirmed in this general area.

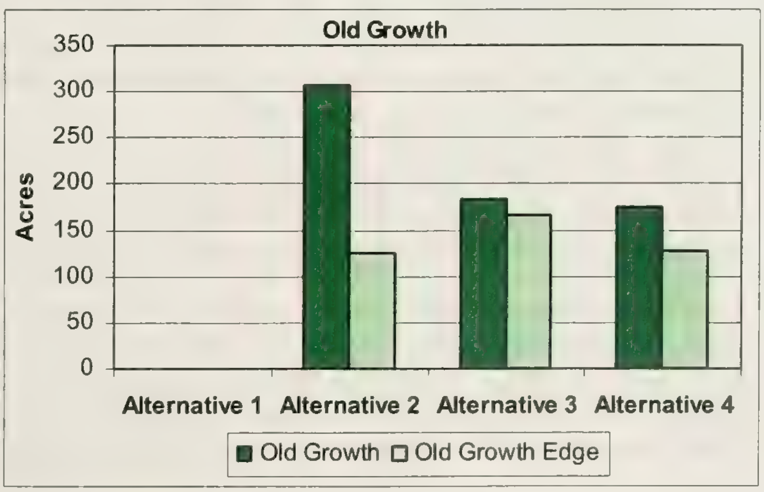
Alternative 1 would not affect the gray wolf and would not change existing conditions for prey base, denning and rendezvous sites, or space with minimal exposure to humans. For all mine alternatives, sufficient populations of elk, deer and other prey species would continue to be maintained, and would continue to provide a good year-round prey base for wolves, and no known den or rendezvous sites would be affected by any of the mine alternatives. All mine alternatives would increase road densities, resulting in increased potential for human disturbance and an increased risk of human-caused wolf mortality. Road densities would increase more for Alternative 2 in the Crazy Planning Subunit, and would remain worse than existing densities until after mine closure.

For all alternatives, impacts to the gray wolf would be reduced through MMC's or the agencies' proposed land acquisition programs. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be closed. For the agencies' alternatives, potential impacts to wolves also would be minimized through road access changes that would create security habitat for prey species and reduce motorized access of wolf habitat, prohibiting employees to carry firearms, removing road-killed big game animals, implementing a transportation plan to reduce mine traffic, and monitoring road-killed animals. Overall, all mine alternatives would have a minimal effect on the gray wolf.

***Canada Lynx.*** The impacts analysis for the Canada lynx follows the objectives, standards, and guidelines established in the Northern Rockies Lynx Management Direction (Lynx Amendment). Standards are evaluated for Lynx Analysis Units (LAUs) that approximate a lynx home range size. Alternatives B, C, and D would comply with Lynx Amendment standards with the following exception. All mine alternatives would affect multi-story or late-successional forest snowshoe hare (lynx denning) habitat and would not meet this standard. Impacts to multi-story or late-successional forest snowshoe hare habitat from mine alternatives would occur only in LAU 14504, and would range from 167 acres for Alternative 3 to 391 acres for Alternative 2.

## Issue 6: Other Wildlife and Key Habitats

***Old Growth.*** Alternative 1 would have no direct effect on designated old growth or associated plant and wildlife. All old growth areas would maintain their existing conditions and continue to provide habitat for those species that use the area over a long term. Alternatives 2, 3, and 4 would reduce the amount of old growth in the Crazy Planning Subunit. Old growth removed for mine facilities would range from 175 acres in Alternative 4 to 307 acres in Alternative 2. Alternatives 2, 3, and 4 would reduce the quality of old growth by creating openings in old growth, or



creating an "edge effect." Edge effects would range from 125 acres in Alternatives 2 and 4, to 167 acres in Alternative 3.

Mine Alternatives 2, 3, and 4 would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 (Designated Old Growth) designation of all harvested stands to MA 31 (Mineral Development). In Alternatives 3 and 4, the KNF would designate 587 acres in Alternative 3 and 657 acres in Alternative 4 of additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Losses and degradation of old growth habitat may be offset by land acquisition associated with grizzly bear habitat mitigation if old growth habitat characteristics were present on the acquired parcels. Sufficient designated old growth would be present below 5,500 feet in all alternatives to be consistent with the KFP direction regarding old growth.

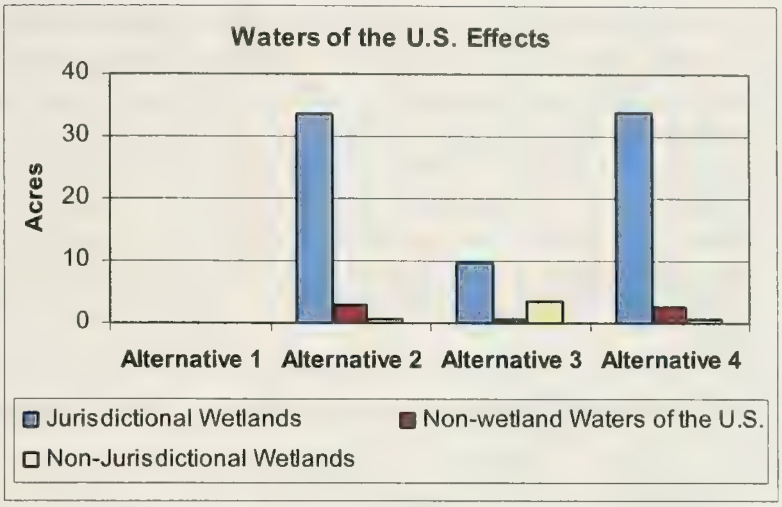
***Pileated Woodpecker.*** In Alternative 1, natural successional processes would continue to occur throughout old growth stands and habitat would continue to be provided for pileated woodpecker nesting pairs where feeding and breeding conditions are suitable. There would be no direct or indirect impacts to pileated woodpecker (old growth habitat) from Alternative 1, and no change in potential population index. The effects on old growth in Alternatives 2, 3, and 4 would reduce nesting and foraging habitat and habitat quality for the pileated woodpecker. The potential population index in Alternatives 2, 3, and 4 would not be affected. Alternatives 2, 3, and 4 would result in the loss of snags and downed logs greater than 10 inches diameter at breast height that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain above KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF.

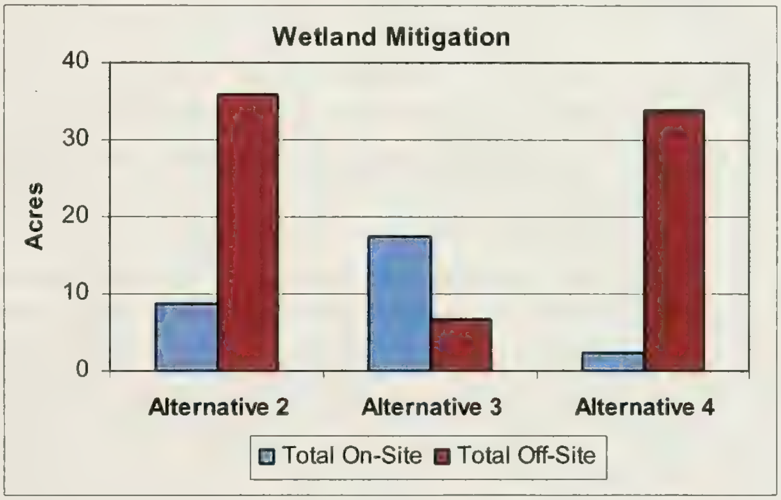
### Issue 7: Wetlands and Non-Wetland Waters of the U.S.

The No Mine Alternative would not disturb or affect any wetlands or waters of the U.S. Any existing wetland disturbances would be mitigated in accordance with existing permits and approvals.

Alternatives 2, 3, and 4 would require the unavoidable filling of jurisdictional wetlands, non-jurisdictional wetlands, and other waters of the U.S. The Corps determines a water to be subject to its jurisdiction if the water body is a traditionally navigable water, relatively permanent, or a wetland that directly abuts a traditionally navigable or relatively permanent water body, or, in combination with all wetlands adjacent to that water body, has a significant nexus with traditionally navigable waters. All waters of the U.S. as well as activities that require the discharge of fill material into wetlands or waters of the U.S. are regulated by the Corps. Based on a Supreme Court 2001 ruling, wetlands that are isolated from other waters of the U.S., and whose only connection to interstate commerce is use by migratory birds, do not fall under Corps' jurisdiction. The terms "isolated" and "non-jurisdictional" wetlands are used synonymously.

Effects of Alternatives 2 and 4 would be similar, affecting 34 acres of jurisdictional wetlands, about 1 acre of non-jurisdictional wetlands, and about 3 acres of other waters of the U.S. Alternative 3 would have less effect than Alternatives 2 and 4. Alternative 3 would affect 9.7 acres of jurisdictional wetlands, 3.4 acres of non-jurisdictional wetlands, and less than 1 acre of other waters of the U.S. In all alternatives, mitigation measures for wildlife and fisheries include




activities in waters of the U.S. Any wetlands and waters of the U.S. disturbed during the implementation of these measures are not accounted for in the acreage listed above. In the short term, these activities would increase sedimentation in area streams and adjacent wetlands and waters of the U.S. After the activities were completed, and the roads became stabilized, these mitigation measures would increase the function and values of any associated wetlands and would decrease sediment delivery to waters of the U.S.

MMC proposes to replace forested and herbaceous wetlands at a 2:1 ratio and herbaceous/shrub wetlands at a 1:1 ratio. On-site mitigation opportunities would involve wetland restoration and wetland creation. A total of 8.8 acres of on-site mitigation is proposed for Alternative 2. Off-site mitigation would occur outside the permit area boundary. A total of 35.8 acres of off-site mitigation would mitigate for effects associated with Alternative 2. Most mitigation sites would be located in the Poorman Creek area. The Corps would be responsible for developing final mitigation ratios, depending on the function and values of the affected wetlands. Replacing herbaceous/shrub wetlands at a 1:1 ratio would not meet the minimum Corps mitigation ratio. Annual monitoring of mitigation sites would ensure mitigation sites were dominated by appropriate vegetation and had comparable function and value to the affected wetlands.

In Alternatives 3 and 4, jurisdictional wetlands would be replaced at a ratio described in Alternative 2 while non-jurisdictional wetlands would be replaced at a 1:1 ratio. Where feasible, wetland soil, sod, and shrubs would be excavated from existing wetlands prior to filling during construction, and placed in the wetland mitigation areas. Sufficient mitigation sites have been identified for Alternative 3 to achieve the Corps' minimum ratios. Mitigation sites identified for Alternative 4 are insufficient to achieve the Corps' minimum ratios, and additional mitigation sites would be necessary if this alternative were permitted.

The effect on wetland, spring, and seep habitat overlying the mine would be the same in Alternatives B, C, and D. The effect on wetlands, springs, and seeps overlying the mine and

downstream of the tailings impoundment is difficult to predict. The effect on plant species, functions, and values associated with the affected wetlands, springs, or seeps by a change in water level would be best determined by relating plant species with water abundance and quality for monitoring and evaluation. Alternative 2 does not include a survey of plant species abundance (all species) prior to activity and subsequent plant species abundance and water monitoring of ground water-dependent ecosystems overlying the mine. Without this type of monitoring, mining-induced changes in water level or quality may result in a loss of species, functions, and values associated with the affected wetlands, springs, or seeps. Additional monitoring of wetlands, springs, and seeps overlying the mine area and tailings impoundment sites would be conducted in Alternatives 3 and 4.

## Draft Findings for Transmission Line Certification Approval

This section summarizes the effects of the transmission line and serves as the draft findings for transmission line certification approval. The DEQ will approve a transmission line facility as proposed or as modified or an alternative to the proposed facility if it finds and determines:

- The need for the facility
- The nature of probable environmental impacts
- That the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives
- What part, if any, would be located underground
- That the facility is consistent with regional plans for expansion of the appropriate grid of the utility systems serving the state and interconnected utility systems
- That the facility will serve the interests of utility system economy and reliability
- That the location of the proposed facility conforms to applicable state and local laws
- That the facility will serve the public interest, convenience, and necessity
- That DEQ has issued all necessary decisions, opinions, orders, certifications, and permits
- That the use of public lands for location of the facility was evaluated, and public lands were selected whenever their use is as economically practicable as the use of private lands (75-20-301[1], MCA)

### Need

In order to determine that there is a need for the proposed electric transmission line, the DEQ must make one of the findings enumerated in ARM 17.20.1606. No electrical distribution system is near the project area. The nearest electrical distribution line parallels U.S. 2 and it is not adequate to carry the required electrical power. The lead agencies considered, but eliminated from detailed analysis, alternatives other than a new transmission line. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

### Probable Environmental Impacts

The probable environmental impacts of the transmission line are described in Chapter 3. The following sections summarize selected effects of the North Miller Creek Alternative (Alternative B) as proposed by MMC along with the agencies' alternatives: Modified North Miller Creek

Alternative (Alternative C), Miller Creek Alternative (Alternative D), and West Fisher Creek Alternative (Alternative E) using the preferred location criteria listed in DEQ Circular MFSA-2, section 3.1. These criteria are:

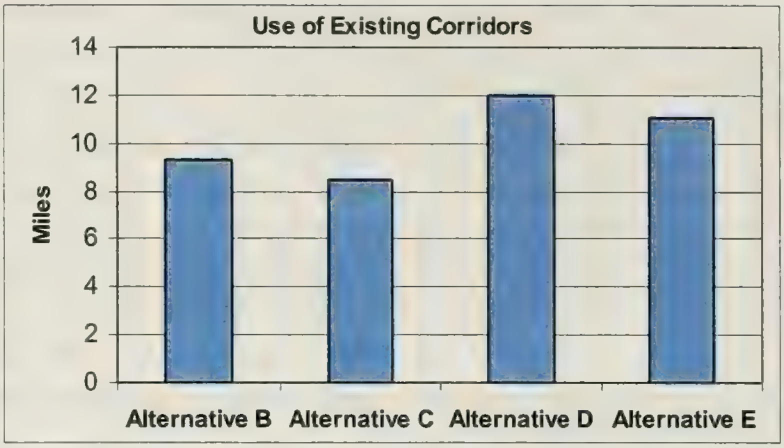
- Where there is the greatest potential for general local acceptance of the facility
- Where they use or parallel existing utility and/or transportation corridors
- Locations in non-residential areas
- Locations on rangeland rather than cropland and on non-irrigated or flood irrigated land rather than mechanically irrigated land
- Locations in logged areas rather than undisturbed forest
- Locations in geologically stable areas with non-erosive soils in flat or gently rolling terrain
- Locations in roaded areas where existing roads can be used for access to the facility during construction and maintenance
- Structures not located on a floodplain
- Where the facility will create the least visual impact
- A safe distance from residences and other areas of human concentration
- In accordance with applicable local, state, or federal management plans when public lands are crossed

None of the transmission line alternatives would cross rangeland or cropland. This preferred criterion is not discussed further. Alternative A, No Transmission Line, would not require the construction and operation of a transmission line. Electrical power would be provided by generators. The No Transmission Line Alternative would not provide a safe and reliable source of electrical power for the mine. Alternative A is not discussed in the following sections on the preferred location criteria.

***General Local Acceptance.*** Issues and concerns about the proposed transmission line were identified during the public involvement process, discussed in Chapter 1. A public meeting on the proposed 230-kV transmission line was held in May 2005 to identify resources potentially affected by the proposed transmission line, suggested locations for the proposed line, alternatives to the proposed line, and mitigation measures for the proposed line. At the meeting, MMC presented information on the need for the proposed facility. Before making its minimum impact determination, the DEQ has solicited additional public comments on impacts of the alternatives as well as the balancing of preferred location criteria, possible impacts resulting from each alternative, and the use of public lands with project costs.

***Use of Existing Corridors.*** No existing transmission line corridors are found in the analysis area. Existing transportation corridors consist of U.S. 2 and open roads on National Forest System lands, such as National Forest System road #231 or #278, and open roads on Plum Creek lands. Alternatives B through E would use or parallel existing road corridors. Alternatives B and C would be similar, with 8 to 9 miles of centerline within 1,000 feet of an existing open road. Alternatives D and E would make greater use of existing corridors, with between 11 and 12 miles centerline within 1,000 feet of these roads.

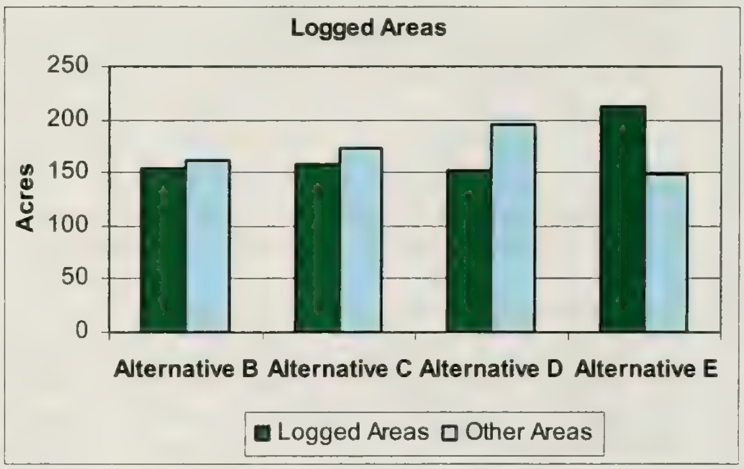
***Location in Non-residential Areas.*** Most of the transmission line corridors are National Forest System lands or private lands owned by Plum Creek Timber Company. Residential areas are not found on either type of land. Fourteen residences are within 1 mile of the four transmission line alternatives. Most of these properties are within 0.5 mile of U.S. 2. Alternative B would be close to more residences than the other three alternatives. Fourteen residences are within 0.5 mile of Alternative B, of which 11 are greater than 450 feet from the centerline of the ROW and the remaining three are within 450 feet.




The seven residences within 0.5 mile of Alternatives C and D are more than 450 feet from the centerline. Six residences are within 0.5 mile of Alternative E, of which four are more than 450 feet from the line and the remaining two are within about 450 feet of the centerline. Montana regulations allow the final centerline to vary by up to 250 feet of the centerline analyzed in this EIS (ARM 17.20.301 (21)), unless there is a compelling reason to increase or decrease this distance. The centerline during final design of this alternative would be no closer than 200 feet of these residences.

Expected noise levels at a residence 400 feet from the centerline during a light rain or wet snows would be between 40 and 45 decibels. This sound level would be slightly above naturally occurring levels and would be faintly discernible. The sound level would be less than 20 decibels during fair weather, and would not be audible over existing sounds. Because BPA's Sedlak Park Substation would not contain a transformer, there would be no audible hum emanating from the substation.

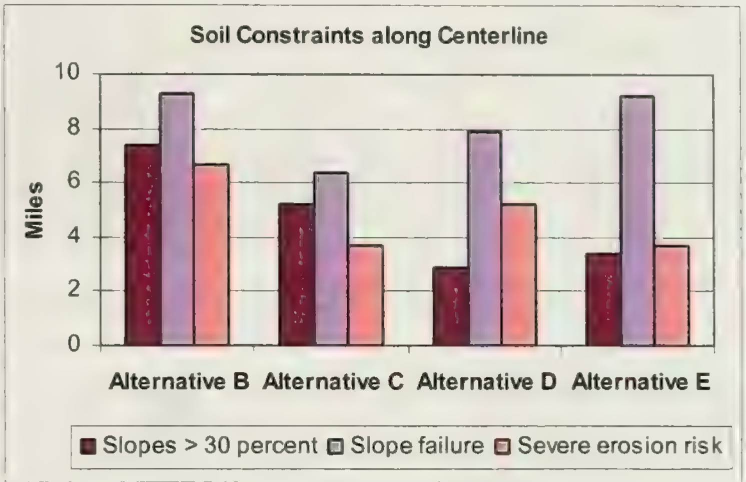
***Logged Areas rather than Undisturbed Forest.*** Alternatives B through E would cross both logged areas and undisturbed forest, riparian, and other areas. About half the area crossed by Alternatives B and C has been logged. Alternative E would cross the most logged areas (210 acres) and least undisturbed areas (150 acres). Alternative D would cross the least logged areas (150 acres) and most undisturbed areas (195 acres).



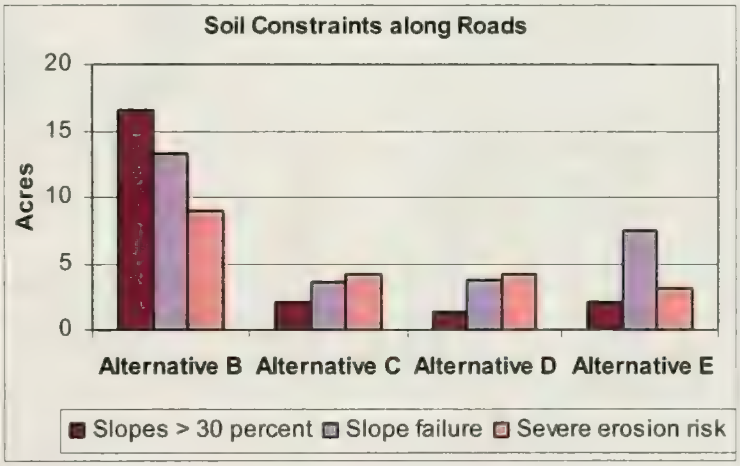

***Geologically Stable Areas with Non-erosive Soils in Flat or Gently Rolling Terrain.*** The terrain in the transmission line analysis area consists of relatively flat alluvial valleys along major creeks and rivers, such as the Fisher River, Miller Creek and West Fisher Creek, or steep hillsides with

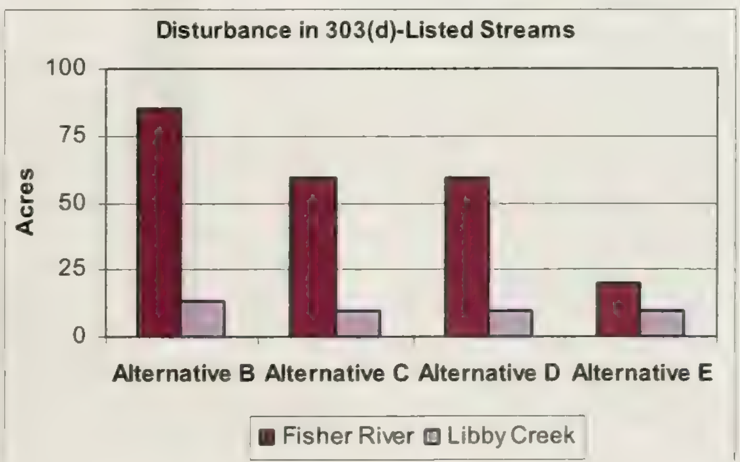
slopes greater than 30 percent. Soils subject to slope failure are found throughout the analysis area, primarily on lower hillslopes. Erosive soils are found along the Fisher River, Miller Creek, and West Fisher Creek.

Of the four alternatives, the centerline of the transmission line of the Alternative B would cross more steep areas (7.4 miles), more soils with a severe erosion hazard (6.7 miles), and more soils subject to failure (9.3 miles) than the other three alternatives. The centerline of Alternatives D and E would cross the least amount of steep slopes, crossing 3 miles of such slopes. The centerline of Alternative C would cross the least amount of soils subject to slope failure.



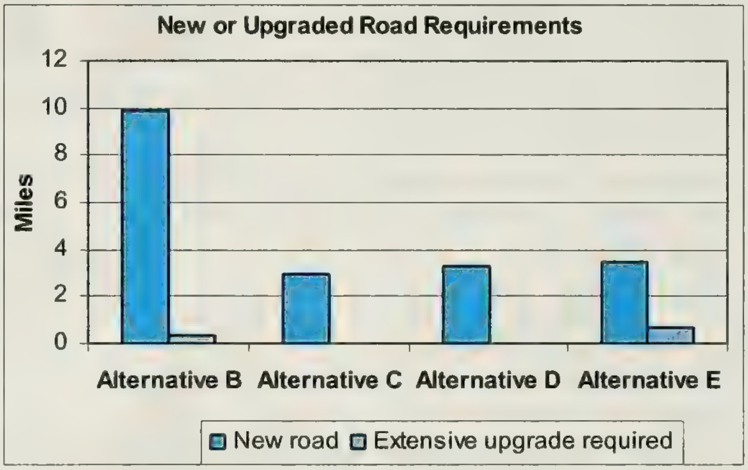

New or reconstructed access roads also would be needed on all transmission line alternatives. Alternative B would have more access roads than the other alternatives. In Alternatives C through E, the need for access roads would be reduced by using a helicopter to set structures in areas of poor accessibility. The access roads in Alternative B would disturb 8.9 acres of soil having severe erosion risk, 13.3 acres of soil having potential for slope failure, and 16.5 acres of slopes greater than 30 percent. Because of the fewer roads in the other alternatives, roads would disturb less than 5 acres of soils with these constraints in Alternatives C and D; Alternative E would disturb 7.4 acres of soils with risk of slope failure.



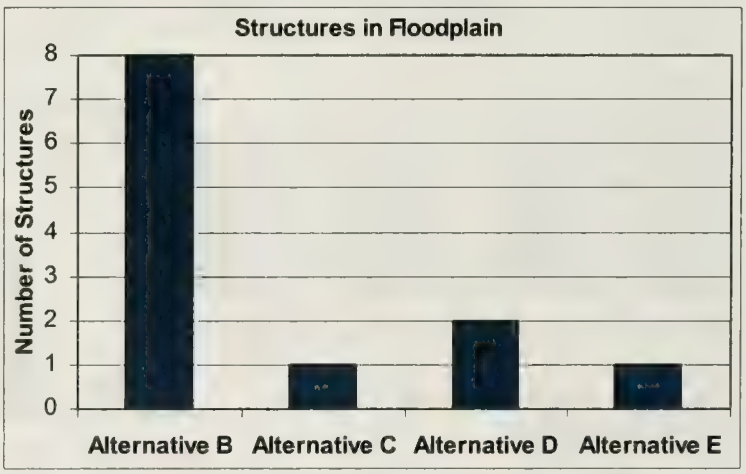




A segment of Libby Creek and the Fisher River are on Montana's list of impaired

streams. Alternative 2 would have 4.7 miles of line paralleling the Fisher River, where soils with severe erosion risk and high sediment delivery are found. Clearing for the transmission line and new or upgraded roads would disturb 85 acres in the watershed. Alternative 2 also would disturb 13 acres in the Libby Creek drainage. The soils at the Libby Creek crossing have severe erosion risk and high sediment delivery. Alternatives C and D would have fewer disturbances in the watersheds of 303(d)-listed streams, disturbing 59 acres in the Fisher River watershed and 10 acres in the Libby Creek watershed. Alternative E would have fewer disturbances in the Fisher River and Libby Creek watersheds than the other alternatives, disturbing 20 acres in the Fisher River watershed, and 10 acres in the Libby Creek watershed. Based on the use of best management practices (BMPs), Environmental Specifications, and other design criteria, these sediment increases would have minimal effects on analysis area streams under most conditions.

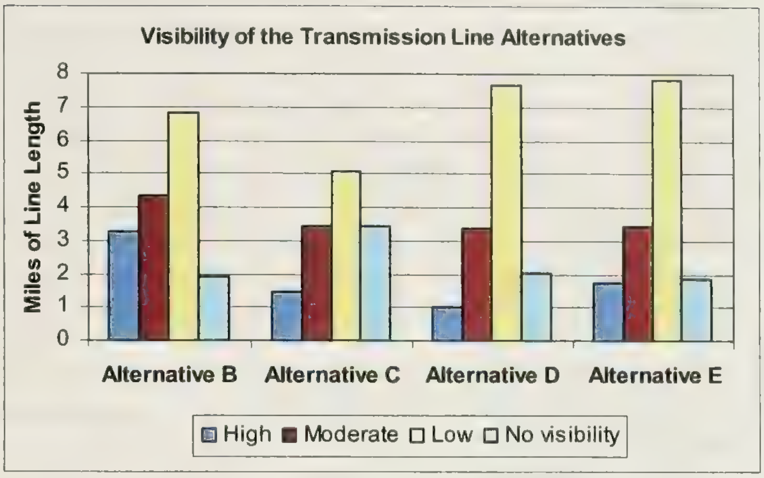



***Roaded Areas.*** Existing roads are found throughout the transmission line analysis area. Most of the roads were used for timber harvest and are currently closed. Four open roads would be used as primary access by one or more the transmission line alternatives: U.S. 2, National Forest System road #231 (Libby Creek Road), National Forest System road #385 (Miller Creek-West Fisher Road), and National Forest System road #4724 (South Fork Miller Creek Road). Alternative B would require about 10 miles of new or roads with extensive upgrade requirements. In Alternatives C through E, the need for access roads would be reduced by using a helicopter to set structures in areas of poor accessibility. These alternatives would need 3 to 4 miles of new or upgraded roads.

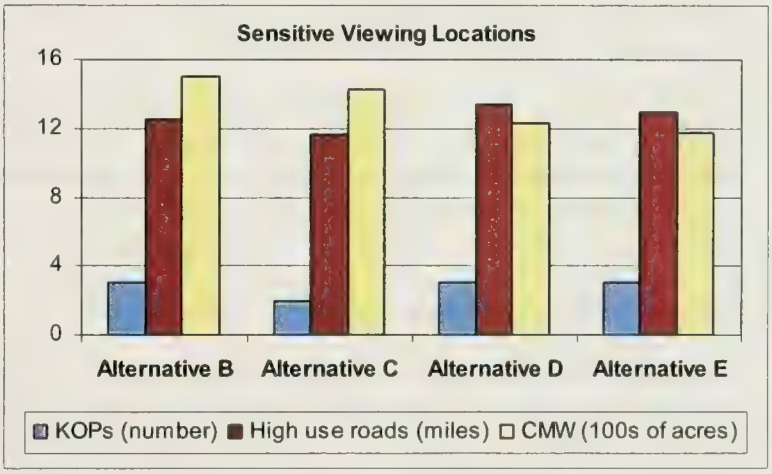



***Structures in a Floodplain.*** One-hundred-year floodplains have been designated along the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Ramsey Creek, and Libby Creek. Eight structures in Alternative B would be located in a designated 100-year floodplain, primarily along the Fisher River. One or two structures would be located in a designated 100-year floodplain in the other three alternatives.

***Visual Impact.*** The analysis area is characterized visually by the summit peaks of the Cabinet Mountains surrounded by the adjacent densely forested mountains and valleys, with some flat, open creek or stream valleys of dense low-growing herbaceous vegetation interspersed with the forest. The four transmission line alternatives would be located in montane forest and valley characteristic landscapes within the KNF. About 3.3 miles of Alternative B would have a high visual impact and 4.4 miles would be moderate. Two miles of Alternative B would not be visible. Alternatives C, D, and E would have similar lengths of high and moderate visibility. Alternative C would have the greatest length of transmission line without any visibility at 3.4 miles.




All alternatives would be visible from KOPs, high use roads, and the CMW. Alternative C would be visible from the fewest KOPs (2) and high use roads (12 miles). Alternatives B, D, and E would be visible from two KOPs. Visibility from high use roads would be the greatest in Alternative D. Effects of views from the CMW would be the greatest in Alternative B and the least in Alternative E.




***Safe Distance from Residences and Other Areas of Human Concentration.*** Fourteen residences are present within 0.5 mile of Alternative B, of which 11 are greater than 450 feet from the centerline of the right-of-way and the remaining three are within 450 feet. Because the final alignment could vary by up to 250 feet of the centerline analyzed in this EIS (ARM 17.20.301 (21)), three residences may be within 200 feet of the centerline depending on final transmission line alignment. At lateral distances from the edge of the right-of-way (50 feet from the centerline) to 200 feet away, the electric field strength would range from about 0.75 kV/m (kilovolt/meter) at 50 feet to about 0.05 kV/m (or 50 V/m) at 200 feet. The magnetic field strength would be about 4 milligauss (mG) at 50 feet and less than 1 mG at 200 feet. This maximum electric strength at 50 feet would be below the level set by Montana regulation for electric field strength, and both the electric and magnetic field strengths at 50 feet would be below the exposure levels for the general public recommended as reference levels or maximum permissible levels.

The seven residences along Alternative C and the eight residences along Alternative D within 0.5 mile are greater than 450 feet from the centerline. Seven residences are within 0.5 mile of Alternative E centerline, of which five are more than 450 feet from the centerline and the remaining two are within 450 feet of the centerline. As part of this alternative, the centerline would be not closer than 200 feet from any residence during final design. The electric field strength would be less than 0.05 kV/m (or 50 V/m) and the magnetic field strength would be less than 1.0 mG. Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the general public, and the current state of scientific research on electric and magnetic fields, these alternatives would be a safe distance from residences and other areas of human concentration.

If approved, the DEQ would require that the project meet minimum standards set forth in the National Electrical Safety Code and Federal Aviation Administration requirements for marking the line.

***Compliance with Local, State, or Federal Management Plans.*** The KFP guides all natural resource management activities and establishes management direction for the KNF in the form of prescriptions consisting of goals, objectives, standards, and guidelines. This direction may be established to apply throughout the forest plan area (forest-wide direction), or it may be established for only a part of the forest plan area, a MA. The Montanore Project is being evaluated under the 1987 KFP. Unincorporated Lincoln County has no comprehensive or general plan, zoning regulations, or growth policies.

The Montana Fish, Wildlife and Parks (FWP) holds a conservation easement on some lands owned by Plum Creek Timber Company where the transmission line may be located. Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek Timber Company or other owners and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless the prior written approval is given by the FWP.

Alternative B would not be in compliance with all goals, objectives, standards, and guidelines of the KFP. For example, Inland Native Fish Strategy standard Minerals Management (MM-2) requires all structures, support facilities, and roads be located outside RHCAs. Where no alternative to siting facilities in RHCAs exists, operators are to locate and construct the facilities in ways that avoid impacts to RHCAs and streams and adverse effects on inland native fish. MMC's Alternative B would locate roads and transmission line structures in RHCAs. The lead agencies' modifications to MMC's proposed alignment and structure placement are incorporated into Alternative C, which would reduce the number of roads and transmission line structures in RHCAs. Compliance with the KFP is discussed in each resource section of Chapter 3. If the selected transmission line were approved by the FWP, it would be in compliance with the FWP-Plum Creek conservation easement.

## Minimized Adverse Environmental Impact

The MFSA requires a finding that the facility as proposed or modified or an alternative to the facility must minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives(75-20-301(1)(c), MCA). ARM 17.20.1607 outlines additional requirements before this finding can be made. In addition,

the final location for the facility must achieve the best balance among the preferred site criteria discussed in the previous section.

In addition to the DEQ's preferred location criteria listed in DEQ Circular MFSA-2, section 3.1, transmission line impacts also were evaluated based on criteria listed in DEQ Circular MFSA-2, sections 3.2(1)(d)(iii) through (xi) and 3.4(1)(b) through (w) (see Appendix J) and other criteria established to meet Forest Service and NEPA requirements. Alternative A, No Transmission Line, would not have additional effects beyond that described for the mine, and is not discussed further. Impacts of transmission line alternatives are summarized below, based on the criteria listed in Appendix J. Other key issues addressed as required by the Forest Service or NEPA are discussed where they relate to DEQ Circular MFSA-2 criteria. Additional Forest Service or NEPA issues that do not fit in the context of MFSA criteria are discussed at the end of this section. Of the key issues identified by the KNF and the DEQ, the transmission line alternatives would have no effect on acid rock drainage, metal leaching, ground water quality or quantity, or surface water quantity, and these issues are not discussed further. The proposed transmission line would have no effect for the following resources listed in DEQ Circular MFSA-2 criteria: national primitive areas; national wildlife refuges and ranges; state wildlife management areas and wildlife habitat protection areas; national parks and monuments; state parks; national recreation areas; designated or eligible wild and scenic river systems; specifically managed buffer areas; state or federal waterfowl production areas; designated natural areas; national historic landmarks, districts, or sites; municipal watersheds; sage and sharp-tailed grouse breeding areas and winter range; high waterfowl population areas; areas of unusual scientific, educational, or recreational significance; areas of high probability of including significant paleontological resources; water bodies; potable surface water supplies, or active faults.

***National Wilderness Areas.*** None of the alternatives would directly affect the wilderness attributes of the Cabinet Mountains Wilderness. Indirect effects to the Cabinet Mountains Wilderness are discussed below for Scenic Quality.

***Roadless Areas over 5,000 acres.*** Alternative B would physically disturb 2 acres of the Cabinet Face East IRA in the Ramsey Creek drainage. Timber harvest for line clearing would occur in the IRA, and 0.1 mile of new roads would be constructed in the IRA under Alternative B. Alternatives C, D, and E would avoid physical disturbance in the Cabinet Face East IRA. No road construction or timber harvest would occur in the IRA.

***Rugged Topography, Soil Erosion, and Sediment Delivery.*** The centerline of Alternative B would cross more areas with slopes greater than 30 percent (7.4 miles), more soils with a severe erosion hazard (6.7 miles), and more soils with high sediment delivery (5.1 miles) than the other three alternatives. The total disturbance for access roads, which would be either new roads or closed roads requiring upgrades, would be greater in Alternative B (30.9 acres) than the other alternatives, followed by Alternative E (12.7 acres). Of the agencies' alternatives, Alternative C would cross the most areas with slopes greater than 30 percent (5.2 miles), Alternative D would cross the most soils with a severe erosion hazard (5.2 miles), and Alternatives C and D would cross the most soils with high sediment delivery (1.5 miles). Slopes greater than 30 percent, areas with severe erosion hazard, and areas with high sediment delivery are shown for all transmission line alternatives in Appendix J.

To minimize erosion risk and sediment delivery, Alternative B would include implementation of erosion and sediment control BMPs; interim reclamation (replacing soil where it was removed

and reseeding) of access roads; immediate stabilization of cut-and-fill slopes; seeding, application of fertilizer, and stabilization of road cut-and-fill slopes and other disturbances along roads as soon as final post-construction grades were achieved; at the end of operations, decommissioning of new roads and reclamation of most other currently existing roads to pre-operational conditions; ripping of compacted soils prior to soil placement, and disking and harrowing of seedbeds. In addition to measures listed for Alternative B, Alternatives C, D, and E would minimize erosion risk and reduce sediment delivery through: re-routing to avoid highly erosive soils; use of H-frame poles, allowing longer spans and fewer structures and access roads; helicopter construction in grizzly bear core habitat to decrease number of access roads; and implementation of a Road Management Plan. For all transmission line alternatives, with implementation of mitigation measures there would be no severe reclamation constraints, no significant adverse impacts to the soil resources, and the soil losses along access roads would likely be minor until vegetation was re-established in most areas after 3 to 5 years. Vegetation re-establishment on steep areas, particularly on south- and west-facing slopes, would take longer.

***Bull Trout Critical Habitat and Occupied Habitat and other Fisheries.*** The Fisher River, West Fisher Creek, Libby Creek, and Ramsey Creek in the transmission line analysis area provide habitat for bull trout, listed as threatened under the ESA. Critical bull trout habitat is found in two segments of West Fisher Creek, 1 to 2 miles west of U.S. 2. Because of barriers, bull trout are not found in Miller Creek or its tributaries.

Bull trout could be affected by increased sedimentation caused by clearing, road construction, and other disturbance associated with the transmission line. All alternatives may affect bull trout and designated critical habitat. All alternatives would cross Howard and Libby creeks 0.3 to 0.4 mile upstream of designated critical habitat on Libby Creek. Alternative E would parallel the designated critical bull trout habitat in West Fisher Creek. The existing Libby Creek Road (National Forest System road #231) would be between the line in Alternative E and any new roads, and West Fisher Creek. As shown in Appendix J, Alternative E would have the most structures within 1 mile of bull trout critical habitat (28), and Alternative B would disturb the most habitat for road construction and upgrades within 1 mile of bull trout critical habitat (3.5 acres). Alternative D would have the fewest structures within 1 mile of bull trout critical habitat (6), and disturb the least habitat for road construction and upgrades within 1 mile of bull trout critical habitat (0.6 acres). Alternative B would result in the most disturbance from clearing and road construction or upgrades in watersheds of occupied bull trout streams (181 acres), followed by Alternative E (179 acres). Alternative D would result in the least disturbance in watersheds of occupied bull trout streams (84 acres).

Three Montana fish Species of Concern are found in the transmission line analysis area streams: interior redband trout, westslope cutthroat trout, and torrent sculpin. Pure populations of interior redband trout are found in the Fisher River, West Fisher Creek, Ramsey Creek, a short segment of Libby Creek below Ramsey Creek, and Midas Creek. Torrent sculpin are found in Libby Creek and Miller Creek. Both torrent and slimy sculpin are found in analysis area streams and cannot be readily identified based on external morphology. Westslope cutthroat trout are found in Howard Creek and Miller Creek. Fish species of concern also are found in Midas Creek and Standard Creek. The transmission line alternatives would result in only minor disturbance in these watersheds, which is unlikely to affect aquatic life. None of the transmission line alternatives would likely contribute to a trend toward federal listing or cause loss of viability of the population of westslope cutthroat trout or interior redband trout.

In addition to mitigation measures described above to minimize erosion and sediment delivery, Alternative B would include implementation of a Storm Water Pollution Prevention Plan and structural and non-structural BMPs; construction of stream crossings per KNF and DEQ requirements; minimization of disturbance on active floodplains; and curtailment of construction activities during heavy rains. Alternatives C, D, and E also would include the following measures: where feasible, location of structures outside of riparian areas; installation of new culverts to allow fish passage; design of stream-crossing structures to withstand a 100-year flow event; and the completion of a habitat inventory and development of instream structures in Libby Creek. Based on the use of BMPs, Environmental Specifications, and other design criteria, sediment increases would have minimal effects on analysis area streams under most conditions.


***Grizzly Bear.*** As discussed in the previous summary of the mine alternatives, an analysis of the independent effects of the transmission line alternatives on the grizzly bear was not completed because of the analysis' complexity. The effects of the combined mine and transmission line alternatives have been discussed previously. The following is an estimate of the effects of the transmission line alternatives. The physical loss of grizzly bear habitat would be low, ranging from 13 to 14 acres in Alternatives C, D, and E to 40 acres in Alternative B. Physical loss would be primarily from construction of roads and the Sedlak Park Substation. The grizzly bear would be displaced temporarily from habitat in all alternatives, ranging from 12,582 acres in Alternative C to 16,501 acres in Alternative E. Some areas affected by displacement from transmission line activities are currently being affected by other activities, such as road use. In all alternatives, displacement effects would be primarily due to helicopter activity. In all alternatives, helicopters would be used for line stringing, which would last about 10 days. In Alternatives C, D, and E, helicopters also would be used in some segments for vegetation clearing and structure construction, prolonging disturbance for up to 2 months. For all alternatives, disturbance of a similar duration also would occur during other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than Alternative C, D, or E. For all transmission line alternatives, except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activity would cease after the transmission line was built until decommissioning. Helicopter use and other transmission line construction activities would cause similar disturbances with similar durations during line decommissioning. Alternatives B and C would follow similar routes, with the exception of the segment of Alternative B in the Ramsey Creek drainage. Alternative C would increase short-term helicopter displacement effects during construction but would reduce road requirements relative to Alternative B. Effects on the grizzly bear would be mitigated through habitat acquisition, access changes, and habitat enhancement.

Small, isolated blocks of core habitat may provide lower quality habitat than large, interconnected blocks. Research suggests that grizzly bears prefer larger blocks of core, although a minimum block size was not determined due to small sample sizes (Wakkinen and Kasworm 1997). During transmission line construction, new road construction in Alternative B would divide and reduce a block of core habitat in the northeast portion of BMU 6, where a narrow band of core habitat occurs, resulting in one large block and two smaller blocks. Core habitat fragmentation would continue until the transmission line was decommissioned in Alternative B. The transmission line alignment in Alternative C would cross the block of core habitat in the northeast portion of BMU 6, but would not reduce core habitat because helicopters would be used for construction in or adjacent to core habitat. Displacement effects from helicopter activity during construction, annual maintenance throughout the project, and transmission line decommissioning in Alternatives B and C would reduce effectiveness of this core habitat block. In Alternatives B and C, core habitat would be altered with a linear transmission line corridor, reducing cover and increasing forage habitat. Clearing of the transmission line corridor could result in improved hunter access, increasing mortality risk.

Alternatives C, D, and E include an access change in NFS road #4725 that would enlarge a block of core habitat in the northeast portion on BMU 6. In Alternatives D and E, the access change would be in the entire length of NFS road #4725 and would be implemented before transmission line construction started. In Alternative C, the additional core habitat created by the access change in NFS road #4725 would be 320 acres smaller and would occur later than in Alternatives D and E. The entire length of NFS road #4725 would be used during construction of Alternative C, and the access change would occur in the upper 2.8 miles of NFS road #4725 after it was no longer needed for transmission line construction.

***Canada Lynx.*** Impact evaluation criteria for the Canada lynx have been discussed in the previous summary of the mine alternatives. All transmission line alternatives would comply with Lynx Amendment standards with the following exception. All transmission line alternatives would affect multi-story or late-successional forest snowshoe hare (lynx denning) habitat and would not meet this standard. Impacts to lynx denning habitat would range from 19 acres for Alternatives C and D, to 31 acres for Alternative B (see Appendix J). Overall lynx habitat disturbed in the transmission line clearing area or for road construction or improvement would range from 79 acres for Alternative C to 193 acres for Alternative D. All transmission line alternatives may affect the Canada lynx. Land acquired for grizzly bear mitigation for the transmission line alternatives would likely improve habitat conditions for lynx and their prey.

***Gray Wolf.*** Impact evaluation criteria for the gray wolf have been discussed in the previous summary of the mine alternatives. The Fishtrap pack is the only known wolf pack potentially affected by the Montanore Project. At least two wolves use portions of the analysis area on a regular basis. No wolf packs or den sites have been confirmed in this general area.

For all transmission line alternatives, sufficient populations of elk, deer and other prey species would continue to be maintained, and would continue to provide a good year-round prey base for wolves, and no known den or rendezvous sites would be affected by any of the transmission line alternatives. Only the outer edge of the Fishtrap pack territory extends to the extreme southeast portion of the analysis area and the Fishtrap pack would not likely be affected by any of the transmission line alternatives. High road densities and transmission line construction activities could have short-term effects on other wolves using the analysis area. Increased road densities, could result in increased potential for human disturbance and an increased risk of human-caused

wolf mortality. During transmission line construction, all transmission line alternatives except Alternative D would increase road densities in the analysis area. Road densities would increase the most for Alternative B. For all transmission line alternatives, open road densities on National Forest System lands would return to existing densities during transmission line operations and after reclamation. Helicopter use and other transmission line construction and ground construction activities could temporarily displace wolves from surrounding habitat. Impacts to wolf habitat would be somewhat reduced through the land acquisition programs proposed by MMC and the agencies especially where roads could be closed. In Alternatives C, D, and E, potential impacts to wolves would be minimized through road access changes that would create security habitat for prey species and reduce motorized access of wolf habitat, prohibiting employees to carry firearms, removing road-killed big game animals, implementing a transportation plan to reduce mine traffic, and monitoring road-killed animals. Overall, all transmission line alternatives would have a minimal effect on the gray wolf.

***Cultural Resources.*** Four eligible cultural sites would be located in the Alternative B alignment and 500-foot buffer, while the buffer area for Alternatives C, D, and E would include three eligible cultural sites. Details about these sites are explained in Chapter 3. For all transmission line alternatives, consultation with the SHPO would be conducted to receive consensus determinations and to develop a plan of action for site 24LN1818. Site 24LN1818 is a portion of U.S. 2 that crosses Alternatives B, C, and D. Because of the ongoing highway modifications, the resource has not been evaluated for the National Register of Historic Places. Additional fieldwork would be necessary prior to SHPO consultation.

***Surface Water Quality.*** Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Howard Creek, and Midas Creek are rated as outstanding (Class 1) for fisheries habitat by the FWP. Clearing within watersheds of Class I or Class II streams would range from 47 acres for Alternatives C and D to 107 acres for Alternative B. Road construction and improvement would disturb less than 1 acre in watersheds of Class I or Class II streams for Alternatives C, D, and E, and 7 acres for Alternative B (see Appendix J).

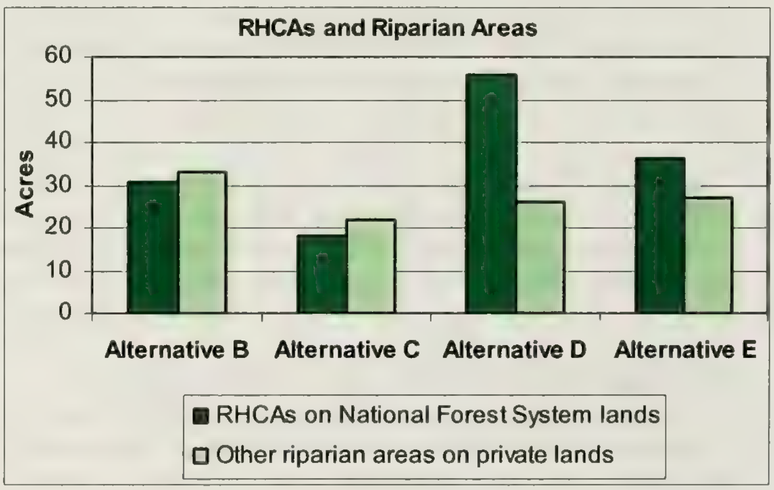
Stream segments on Montana's 303(d) list of impaired streams in the analysis area are described in the previous summary of the mine alternatives. Clearing within watersheds of 303(d)-listed streams would range from 29 acres for Alternative E to 95 acres for Alternative B. Road construction and improvement disturbance in watersheds of 303(d)-listed streams would range from less than 1 acre for Alternative E to 4 acres for Alternative B (see Appendix J).

***Scenic Quality.*** In transmission line Alternatives B, C, D, and E, the KNF would amend the KFP by reallocating certain areas disturbed by the 230-kV transmission line on National Forest System lands as MA 23. MA 23 has a Visual Quality Objective (VQO) of Maximum Modification. The MAs that would not be reallocated to MA 23 currently have a VQO of Maximum Modification. All transmission line facilities would be in compliance with a VQO of Modification or Maximum Modification. Some segments of all transmission line alternatives would be visible from some locations within the Cabinet Mountains Wilderness, as shown in Appendix J.

***Big Game Winter and Security Habitat.*** All transmission line alternatives would disturb winter habitat for moose, elk, and white-tailed deer and security habitat for elk. Security habitat offers elk refuge and reduces their vulnerability during the hunting season. For this analysis, elk security habitat is defined as areas that are larger than 250 contiguous acres and more than 0.5 mile from an open road. Alternative C would disturb the most elk winter range (174 acres), and Alternative

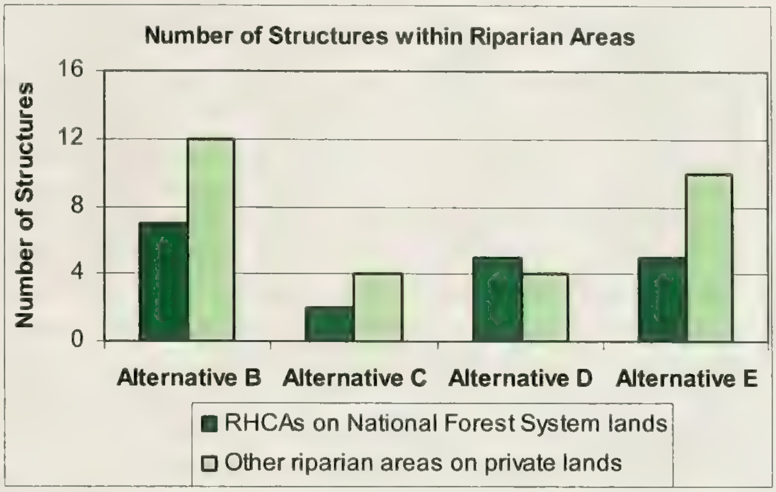
E would disturb the least (93 acres) (see Appendix J). Disturbance impacts to white-tailed deer winter range would range from 149 acres for Alternative B to 208 acres for Alternative D. The most moose winter range would be disturbed by Alternative E (210 acres) and the least by Alternative B (146 acres). Only Alternatives B and C would affect elk security habitat, disturbing 49 acres and 84 acres, respectively. For all transmission line alternatives, impacts to big game winter habitat would be mitigated through winter construction timing restrictions in white-tailed deer winter range. Land acquisition programs proposed by MMC and the agencies, especially where roads could be closed, also would mitigate impacts to big game. Additional mitigation measures included in Alternatives C, D, and E would be the creation of security habitat through road access changes and monitoring road-killed animals to determine if improved access results in increased wildlife mortality.

***Mountain Goat.*** Only Alternative B would physically disturb mountain goat habitat, affecting 47 acres. Helicopter use and other transmission line construction activities associated with the transmission line alternatives are described above for grizzly bear. Helicopter and other transmission line construction activities could temporarily displace goats from suitable habitat or reduce their ability to effectively use the available habitat in the short term. Individual goats could suffer increased stress levels from helicopter and construction disturbance. During the construction phase, Alternative B would result in additional short-term disturbance to 3,877 acres of goat habitat, primarily due to helicopter line stringing in the Ramsey Creek area. Additional disturbance effects would be less for Alternatives C, D, and E, ranging from 624 acres for Alternative C to 729 acres for Alternatives D and E. Impacts to mountain goats could be reduced through land acquisition programs proposed by MMC and the agencies, if acquired land provides suitable goat habitat and could be managed to benefit mountain goats.

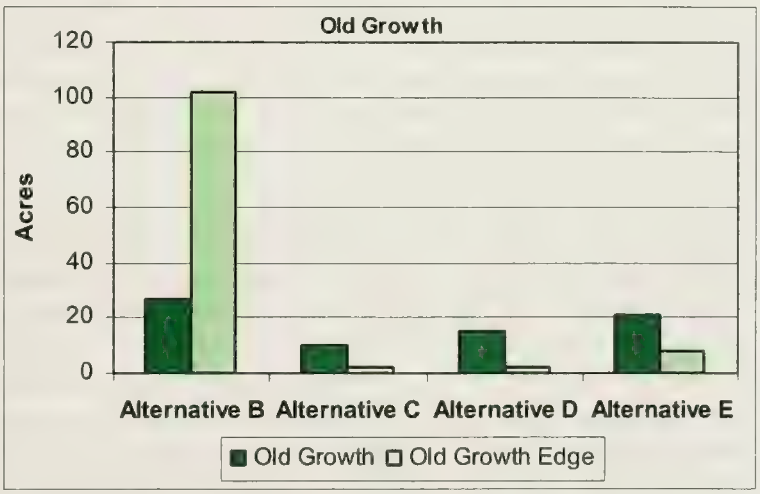



***Riparian Habitat Conservation Areas.*** Alternatives B through E would require construction of roads and other facilities in RHCAs and other riparian areas. Protection of RHCAs was a key criterion in the alternatives analysis and development of alternatives. The lead agencies did not identify a practicable alternative that would avoid locating transmission line facilities or timber harvest in RHCAs. Effects on RHCAs would range from 18 acres in Alternative C to 56 acres in Alternative D; effects on riparian areas on state and private land would range from 22 acres in Alternative C to 33 acres in Alternative B. In Alternatives C, D, and E, MMC would develop and implement a final Road Management Plan to reduce effects on RHCAs. The plan would describe for all new and reconstructed roads criteria that govern road operation, maintenance, and management; requirements of pre-, during-, and post-storm inspection and maintenance; regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives;

implementation and effectiveness monitoring plans for road stability, drainage, and erosion control; and mitigation plans for road failures.




A KFP standard is to locate structures and support facilities, such as transmission line, outside of RHCAs, unless no alternative exists. Alternative B would have more structures located in RHCAs and other riparian areas, with seven structures on RHCAs and 12 structures on riparian areas on state and private land. Structures in RHCAs in the other alternatives would be fewer, ranging from two in Alternative C and five in Alternatives D and E. Similarly, fewer structures would be located in other riparian areas in the other alternatives, ranging from four in Alternatives C and D, and 10 in Alternative E. Effects on RHCAs in Alternatives C, D, and E would be minimized by development and implementation of a Vegetation Removal and Disposition Plan. Heavy equipment use in RHCAs would be minimized. Shrubs in RHCAs would be left in place unless they had to be removed for safety reasons.




***Old Growth Habitat.*** Old growth in the transmission line corridors is found in small blocks along the Fisher River, Miller Creek, West Fisher Creek, and Libby Creek. Alternatives B through E would remove old growth and reduce the effectiveness of old growth adjacent to new disturbances. Loss of old growth would range from 10 acres in Alternative C to 27 acres in Alternative B. Edge effects would range from 102 acres in Alternative B to 2 acres in Alternatives C and D. Increased new road construction contributes to the edge effect of Alternative B. The reduction of old growth on National Forest System lands would be mitigated in Alternatives C, D, and E by the designation of undesignated old growth to designated old growth (MA 13).

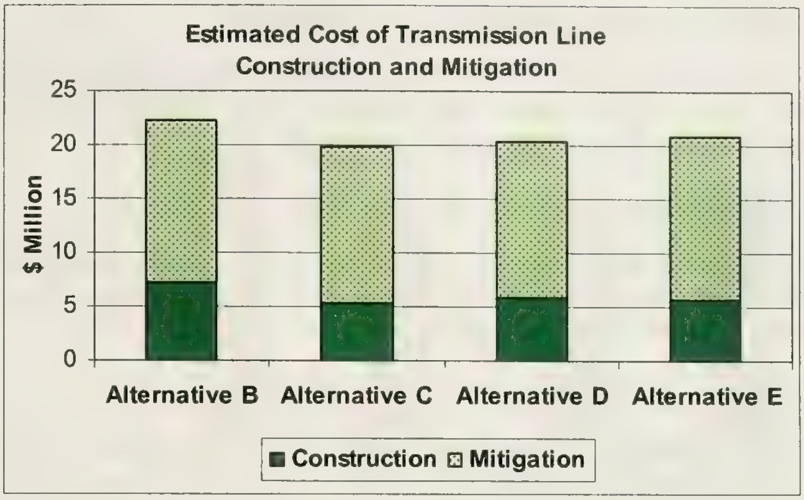
Transmission line Alternatives B through E would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 designation of all harvested stands to MA 23. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Losses and degradation of old growth

habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels. All alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each 3rd-order drainage or compartment, or a combination of compartments.

***Pileated Woodpecker.*** The pileated woodpecker is a Management Indicator Species (MIS) for old growth and snag habitat in the KNF. The effects on old growth in the transmission line alternatives, especially edge effects, would reduce nesting and foraging habitat and habitat quality for the pileated woodpecker. The potential population index in the transmission line alternatives would not be affected. All transmission line alternatives would result in the loss of snags and downed logs greater than 10 inches diameter at breast height that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain above KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels and they could be managed to benefit pileated woodpeckers.

***Wetlands.*** Direct effects to wetlands and waters of the U.S. are expected to be mostly avoided by placement and location of the transmission structures outside of wetlands and waters of the U.S. The BPA would avoid all wetlands at the Sedlak Park Substation Site. Unavoidable wetland direct effects would be determined during final design. No isolated wetlands were identified within the clearing area of any transmission line alternative. About 1.6 acres of wetlands would be within the Alternative B transmission line clearing area. No wetlands would be in the clearing area for Alternatives C, D, and E. Waters of the U.S. within the clearing area would range from 1.2 acres for Alternative C to between 8.2 and 10.2 acres for Alternatives B, D, and E. For all transmission line alternatives, new or upgraded road construction would affect less than 0.2 acre of wetlands and waters of the U.S. Indirect effects to wetlands from road construction, such as sediment or pollutant delivery, would be minimized through implementation of BMPs and appropriate stream crossings.

***Transmission Line Construction Costs.*** Resource-specific impacts and cumulative impacts are described in the previous section and discussed in Chapter 3. Monetary values of these impacts cannot reasonably be quantified. Many potential adverse environmental impacts would be minimized through measures proposed by MMC and the application of the agencies' proposed measures that would be included in Environmental Specifications. Agency proposed mitigation measures would be included as conditions in the certificate should the DEQ approve the transmission line. Proposed Environmental Specifications for the transmission line, including environmental protection and monitoring measures, are described in Appendix D and are further detailed in ARM 17.20.1901.




Estimated transmission line construction costs range from $7.3 million for Alternative B to $5.4 million for Alternative C. High steel costs would make the steel monopoles proposed in Alternative B considerably more expensive than the wooden H-frame structures proposed in the other alternatives. The lower cost of wooden H-frame structures in Alternatives C, D, and E would offset the cost of helicopters to set structures and clear timber in these alternatives. Estimated mitigation costs range from $14.4 million for Alternative C to $15.0 million for Alternative E. Cost estimates are based on preliminary design and material costs in early 2008.

## Locating Transmission Lines Underground

No part of the transmission line would be built underground. Digging trenches to bury the lines would require greater construction disturbance and would require longer time to install. The need for access roads and the associated surface disturbance would be greater. Except along the drainage bottoms, the analysis area is steep, with slopes greater than 30 percent common. Underground line installation and access road construction on steep slopes would have more environmental impact than above-ground construction. Above-ground access vaults would need to be constructed as well as above-ground structures at line termination points. Vegetation would likely have to be restricted to avoid reducing soil moisture needed to cool the transmission line. Problems with an underground system also would be more difficult to locate and repair. An underground transmission line would cost between 1.5 and 5 times the amount required to build an overhead line (Electric Power Research Institute 2006). Locating the transmission line underground was dismissed because of the greater surface disturbance and cost.

## Consistency with Regional Plans for Expansion

The transmission line would allow the mine to connect to the regional electrical transmission grid. While there is no single formal published plan for expansion of the regional grid, the line would be consistent with plans for expansion of the BPA grid in the area. The line would not significantly add to the ability of the grid as a whole to deliver electricity because the purpose of the line would be to serve only the mine loads. The BPA has completed the studies necessary to interconnect the proposed line to BPA's Libby-Noxon 230-kV line. BPA's study indicated the proposed line would not have a significant effect on the interconnected system (Bonneville Power Administration 2006).

## Utility System Economy and Reliability

The BPA has completed the study indicating that the proposed interconnection would not adversely affect BPA's system (Bonneville Power Administration 2006). Operating the proposed line at 230 kV would help ensure low line losses.

## Conformance with Applicable State and Local Laws

The location of the facility would conform to applicable state and local laws and regulations either as a permitting or certification condition or in compliance with project-specific Environmental Specifications (see Chapter 1).

## Public Interest, Convenience, and Necessity

The proposed transmission line would be built to meet the need for additional transfer capacity to the mine. Benefits to MMC would be the monetary profit from operating the mine and transmission line. Benefits to the state include local tax revenues to counties in which the line and mine are located, state tax revenues from the line and mine, a short-term beneficial effect on local economies from construction of the line and mine, and a long-term beneficial effect on local economies from maintenance of the line.

Economic impacts due to the proposed transmission line would be minimal at a state level. Construction benefits due to the line would be short-term. Line maintenance employment benefits and tax benefits would be long-term but small at both a county and state level. Total costs include mine and transmission line construction and operation costs and costs due to environmental impacts described in Chapter 3. Costs of these environmental impacts cannot be reasonably quantified in monetary terms.

The proposed transmission line is unlikely to have adverse affects on public health, welfare, and safety because the line would conform to the requirements of the National Electrical Safety Code and DEQ standards for electric field strength in residential or subdivided areas and at road crossings. Sensitive receptors such as residences would be located at distances sufficient that even the most restrictive suggested standards for magnetic fields would be met under normal operating conditions. Alternatives C, D, and E would be constructed in a manner that minimizes adverse impacts to soil, water, and aquatic resources.

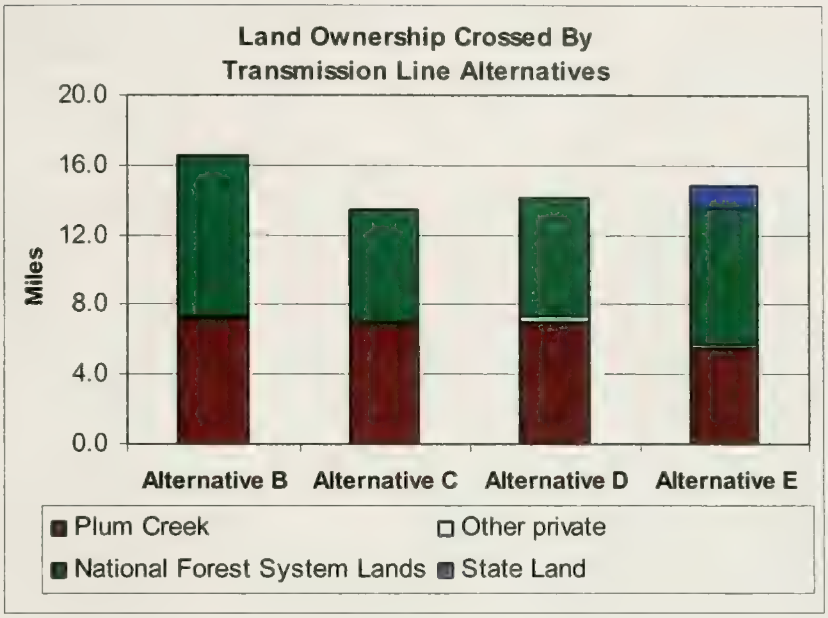
The DEQ will consider additional comments on the benefits and costs of the Montanore line, and will make a final determination on public interest, convenience, and necessity after comments on this Draft EIS are analyzed.

## Public and Private Lands

The use of public lands for location of the facility was evaluated, and public lands were incorporated into alternatives whenever their use was as economically practicable as the use of private lands (75-20-301(1)(h), MCA). All of the transmission line alternatives would be located primarily on National Forest System lands and private land owned by Plum Creek. Alternative B, C, and D would cross between 7 and 7.4 miles of private and Plum Creek land. Alternative E would cross the least amount of private land (5.7 miles). The agencies did not identify an alternative that would avoid the use of private land.

### DEQ Issuance of Necessary Decisions, Opinions, Orders, Certifications, and Permits

As appropriate, the DEQ would issue all necessary environmental permits for the transmission line at the time the decision is made on whether to grant a certificate for the facility.




## Where to Obtain More Information

More information on the proposed Montanore Project can be found on the KNF's website: www.fs.fed.us/r1/kootenai/projects/projects/montanore/index.shtml, or the DEQ's website: http://www.deq.mt.gov/eis.asp. If you have any additional questions or concerns, please contact the individuals listed below.

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# Chapter 1. Purpose of and Need for Action

## 1.1 Document Structure

Montanore Minerals Corp. (MMC) proposes to construct a copper and silver underground mine and associated facilities, including a new transmission line. The proposed project is called the Montanore Project. MMC has requested the U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF) to approve a Plan of Operations for the Montanore Project.

From the DEQ's perspective, the mining operation is covered by a DEQ Operating Permit first issued by the Montana Department of State Lands (DSL) to Noranda Minerals Corp. (Noranda). MMC has applied to the Montana Department of Environmental Quality (DEQ) for a modification of the existing permit to the extent that its proposed Plan of Operations submitted to the KNF differs from the DEQ Operating Permit. MMC has also applied to the DEQ for a certificate of compliance to allow for construction of the transmission line.

The KNF and the DEQ are the lead agencies and have prepared this draft environmental impact statement (Draft EIS) in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA). These laws require that if any action taken by the DEQ or the KNF may "significantly affect the quality of the human environment," an Environmental Impact Statement (EIS) must be prepared. This Draft EIS also has been prepared in compliance with the USDA NEPA policies and procedures (7 Code of Federal Regulations (CFR) 1b), the Forest Service's Environmental Policy and Procedures Handbook (Forest Service Handbook 1909.15), DEQ's MEPA regulations (ARM 17.4.601 *et seq.*) and the U.S. Army Corps of Engineers' (Corps) NEPA implementation procedures for its regulatory program (Appendix B of 33 CFR 325). This Draft EIS discloses the potential direct, indirect, and cumulative environmental impacts that would result from the proposed mine and alternatives and serves as a draft of a report required under the Major Facility Siting Act (MFSA). The document is organized into four chapters:

- Chapter 1. Purpose of and Need for Action: Chapter 1 includes information on the history of the proposed project, the purpose of and need for the proposed project, and the lead agencies' proposal for achieving that purpose and need.
- Chapter 2. Alternatives, Including the Proposed Action: This chapter summarizes how the KNF and the DEQ informed the public of the proposal and how the public responded. This chapter provides a more detailed description of MMC's Proposed Action as well as the lead agencies' alternative methods for achieving the project's purpose. These alternatives were developed based on key issues raised by the public and other agencies and include mitigation measures to reduce impacts.
- Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the affected environment and environmental effects of implementing the Proposed Action or other alternatives. This analysis is organized alphabetically by resource.
- Chapter 4. Consultation and Coordination: Chapter 4 provides a list of preparers and agencies consulted during the development of the Draft EIS.

Appendices: The following appendices provide more detailed information to support the analyses presented in the Draft EIS:

- Appendix A—1992 Board of Health and Environmental Sciences Order
- Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternatives
- Appendix C—Surface Water, Ground Water, and Aquatic Life Monitoring Plans, Alternatives 3 and 4
- Appendix D—Proposed Environmental Specifications for the 230-kV Transmission Line
- Appendix E—Past and Current Actions Catalog for the Montanore Project
- Appendix F—Supplemental Macroinvertebrate Data
- Appendix G—Water Quality Mass Balance Calculations
- Appendix H—Various Streamflow Analyses
- Appendix I—Visual Simulations
- Appendix J—Transmission Line Minimal Impact Standard Assessment

Additional documentation, including more detailed analyses of project-area resources, may be found in the project record located at the KNF Supervisor's Office in Libby, Montana, and in the project record at DEQ's Environmental Management Bureau in Helena, Montana.

This disclaimer pertains to all geographic information system (GIS) maps within this document:

> These products are reproduced from geospatial information prepared, in part, by the USDA KNF and other sources. GIS data and product accuracy may vary. They have been developed from sources of differing accuracy and resolution, accurate only at certain scales, based on modeling or interpretation, and some sources may have been incomplete while being created or revised. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The KNF reserves the right to correct, update, modify, or replace its GIS products without notification.

## 1.2 Project Area Description

The Montanore Project is located 18 miles south of Libby near the Cabinet Mountains of northwestern Montana (Figure 1; all figures are bound separately in Volume 3 of this document). The ore body is beneath the Cabinet Mountains Wilderness (CMW). All access and surface facilities including the 230-kV transmission line would be located outside of the CMW boundary (Figure 2). The proposed operating permit areas for the mine facilities would be within sections 13, 14, 15, 22, 23, 24, 26, 27, 35, and 36, Township 28 North, Range 31 West, sections 2, 3, 9, 10, 11, 14, 15, and 29, Township 27 North, Range 31 West, and sections 18 and 19, Township 28 North, Range 30 West, all Principal Meridian, in Lincoln and Sanders counties, Montana.

# 1.3 Background

## 1.3.1 Mineral Rights

On January 1, 1984, the CMW was withdrawn from mineral entry under provisions of the Wilderness Act, subject to valid existing rights. The Wilderness Act requires federal agencies, such as the KNF, to ensure that valid rights exist prior to approving mineral activities inside a congressionally designated wilderness. To establish valid existing rights, mining claimants must show they have made a discovery of a valuable mineral deposit on the claim(s) prior to the withdrawal date, and have maintained that discovery.

The discovery of mineral deposits for the Montanore Project dates back to the early 1980s. In 1980, Heidelberg Silver Mining Company (Heidelberg) located certain mining claims in sections 29 and 30 of Township 27 North, Range 31 West, P.M., Sanders County, Montana. Subsequently, in 1983, Pacific Coast Mines, Inc. (Pacific), a subsidiary of U.S. Borax and Chemical Corporation (Borax), located other mining claims in sections 29 and 30 of Township 27 North, Range 31 West, P.M., Sanders County, Montana. The mining claims located by Pacific in 1983 included the lode mining claims Hayes Ridge (HR) 133 and HR 134 adjacent to Rock Lake. (These claims are shown on Figure 11) This outcrop contained stratabound copper-silver mineralization, extending over a 200-foot vertical thickness.

The deposit is part of the Rock Creek-Montanore deposit, as described by Boleneus *et al.* (2005). The Rock Creek-Montanore deposit has two sub-deposits, the Rock Lake sub-deposit, which was discovered by Pacific, and the Rock Creek sub-deposit, which is proposed to be mined by the Rock Creek Project. The Rock Creek portion of the deposit is separated from the Montanore (Rock Lake) portion by the Rock Lake fault. Exploration drilling was conducted across the deposit in 1983 and 1984.

In 1984, Pacific leased Heidelberg's mining claims pursuant to the terms of a 1984 Lease and Option to Purchase Agreement (Lease Agreement). Subsequently, in 1988, Heidelberg was merged into Newhi, Inc. (Newhi), a subsidiary of Mines Management, Inc. (MMI). As a result of that merger, Newhi became the successor in interest to Heidelberg under the Lease Agreement. Also in 1988, Pacific assigned its interest in HR 133 and HR 134 and its interest in the Lease Agreement to Noranda Minerals Corporation (Noranda), a subsidiary of Noranda Finance Inc. (Noranda Finance).

In 1991, Noranda filed an application with the Bureau of Land Management (BLM) for patent of the HR 133 and HR 134 mining claims (Patent Application MTM 80435). In 1993, a Mining Claim Validity Report was issued by BLM recommending that BLM issue a patent to Noranda for HR 133 and HR 134. In 2001, a patent was issued to Noranda for the portion of HR 134 that lies outside the CMW (Patent Number 25-2001-0140). A separate patent was issued to Noranda for the mineral deposits for HR 133 and the portion of HR 134 that lies inside the CMW (Patent Number 25-2001-0141). These two claims straddle the wilderness boundary, and cover 22 acres inside the CMW, for which Noranda received only the rights to the mineral estate with the federal government retaining the surface rights, and 14.5 acres outside the CMW, for which Noranda received fee title (surface and mineral rights). These patented mining claims contain the surface exposure of the ore body proposed for mining by the Montanore Project. The ore body extends north of the patented claims.

In 2002, Noranda terminated the Lease Agreement with Newhi. Pursuant to the terms of that agreement, Noranda conveyed its interest in HR 133 and HR 134 to Newhi. In 2006, Newhi acquired all of the issued and outstanding shares of Noranda. Immediately following the acquisition of Noranda, Noranda's name was changed to Montanore Minerals Corporation (MMC).

## 1.3.2 Previous Permitting and Approvals

### 1.3.2.1 General Mine and Transmission Line Approvals

The permitting process for the Montanore Project began in 1989. In that year, Noranda obtained an exploration license from the Montana Department of State Lands (DSL) and other associated permits for construction of an exploration adit from private land in upper Libby Creek. Soon after obtaining the exploration license, Noranda began excavating the Libby Adit. Noranda also submitted a "Petition for Change in Quality of Ambient Waters" (Petition) to the Board of Health and Environmental Sciences (BHES) requesting an increase in the concentration of select constituents in surface and ground water above ambient water quality, as required by Montana's 1971 nondegradation statute. After constructing 14,000 feet of the Libby Adit, Noranda ceased construction in 1991 in response to elevated nitrate concentration in surface water and low metal prices.

Although construction ceased in 1991, the permitting process continued. Specifically, the KNF, the Montana Department of Health and Environmental Sciences (DHES), the Montana Department of Natural Resources and Conservation (DNRC), and the DSL, DEQ's predecessor agency, prepared a Draft, Supplemental Draft, and Final EIS on the proposed project. The environmental review process culminated in 1992 with BHES's issuance of an Order approving Noranda's Petition (BHES 1992) and the DSL's issuance of a Record of Decision (ROD) and DEQ Operating Permit #00150 (DSL 1992) to Noranda. In 1993, the KNF issued its ROD (KNF 1993), the DNRC issued a Certificate of Environmental Compatibility and Public Need under MFSA (DNRC 1993), and the Army Corps of Engineers issued a 404 permit (Corps 1993). These decisions selected mine and transmission line alternatives that allowed for the construction, operation, and reclamation of the project.

### 1.3.2.2 Water Quality-Related Approvals

The BHES Order, issued to Noranda in 1992, authorized degradation and established nondegradation limits in surface and ground water adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established numeric nondegradation limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface and ground water), as well as nitrate (ground water only), and total inorganic nitrogen (surface water only). Pursuant to BHES's Order, these nondegradation limits apply to all surface and ground water affected by the Montanore Project and remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992). The Order also adopted the modification developed in Alternative 3, Option C, of the Final EIS, addressing surface and ground water monitoring, fish tissue analysis, and in-stream biological monitoring. The Order is presented in Appendix A.

The Order also indicates that land application and disposal (LAD) treatment, as then proposed, would satisfy the requirement in ARM 16.20.631(3) (now ARM 17.30.635(3)) to treat industrial wastes using technology that is the best practicable control technology available, or, if such

technology has not been determined by the EPA, then the equivalent of secondary treatment as determined by the DEQ. In 1992, the DHES (now DEQ) determined that LAD treatment, with at least 80 percent removal of nitrogen, would satisfy the requirements of ARM 16.20.631(3). The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved.

In 1997, a Montana Pollutant Discharge Elimination System (MPDES) permit was issued to Noranda by the DEQ (MT-0030279) to allow discharges of water flowing from the Libby Adit to Libby Creek. Three outfalls were included in the permit: Outfall 001 – percolation pond; Outfall 002 – infiltration system of buried pipes; and Outfall 003 – pipeline outlet to Libby Creek. Surface discharge from the adit ceased in 1998 and water in the adit flowed to the underlying ground water.

#### 1.3.2.3 Current Status of Existing Permits

As discussed above, Noranda conveyed its interests in lode claims HR 133 and HR 134 to Newhi in 2002. By that time, many of Noranda's permits for the Montanore Project terminated or expired, such as DEQ's air quality permit, the Corps' 404 permit, KNF's approval, and the State's certification of the transmission line. In 2002, Noranda notified the KNF it was relinquishing the authorization to operate and construct the Montanore Project. Noranda's DEQ Operating Permit #00150 and MPDES permit were not terminated because reclamation of the Libby Adit was not completed.

In 2005, MMI submitted an application for a hard rock operating permit to the DEQ and a proposed Plan of Operations for the proposed Montanore Project to the KNF. MMI also submitted to the DEQ an application for a 230-kV transmission line certificate of compliance, an application for an air quality permit, and an application for a MPDES permit that covered additional discharges not currently permitted under the existing MPDES permit for the Libby Adit.

In 2006, Newhi acquired all of the issued and outstanding shares of Noranda pursuant to the terms of a Stock Transfer Agreement between Noranda Finance, Newhi, and MMI. Although the name of Noranda was changed to Montanore Minerals Corporation (MMC) immediately following Newhi's acquisition of Noranda's shares, MMC (formerly Noranda) remains the holder of DEQ Operating Permit #00150 and the existing MPDES permit for the Montanore Project. Following the acquisition of Noranda, MMI and MMC advised the agencies that MMC will be the owner and operator of the Montanore Project. Consistent with that indication, Newhi has re-conveyed HR 133 and HR 134 to MMC, and MMI and MMC have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC to modify the DEQ Operating Permit #00150 (Klepfer Mining Services 2008a). MMC submitted an updated Plan of Operations to the agencies in 2008 that clarified differences between the 2005 Plan of Operations and DEQ Operating Permit #00150. It also incorporated plans required by DEQ Operating Permit #00150 and additional environmental data collected since 2005 (MMC 2008).

#### 1.3.2.4 Libby Adit Evaluation Drilling Program

In 2006, MMC submitted, and the DEQ approved, two requests for minor revisions to DEQ Operating Permit #00150 (MR 06-001 and MR 06-002). The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that Noranda began in 1989. The key elements of the revisions include: excavation of the Libby Adit portal; initiation of water

treatability analyses; installation of ancillary facilities; dewatering of the Libby Adit decline; extension of the current drift; and underground drilling and sample collection. The KNF has not approved any activities at the Libby Adit that may affect National Forest System lands.

Under the revisions, the Libby Adit would be dewatered and water would be treated prior to discharging to one of three MPDES permitted outfalls. The Libby Adit would be rehabilitated and the drift extended 3,300 feet. An additional 7,100 feet including 16 drill stations would be developed under the currently defined ore zones. An estimated 256,000 tons (174,000 cubic yards) of waste rock would be generated and stored at the Libby Adit site.

The evaluation drilling program (MR 06-002) is designed to delineate the first 5 years of planned production. An estimated 35,000 feet of primary drilling and 12,800 feet of infill drilling are planned. The drill core would be used to support resource modeling, mine planning, metallurgical testing, preliminary hydrology assessment, and rock mechanic studies for the full Montanore Project. If adit closure and site reclamation were necessary after completion of the evaluation drilling program, MMC would install a concrete-reinforced hydraulic plug in bedrock, reconstruct the original adit plug, remove all surface facilities, and regrade and revegetate the disturbed areas. Additional information about the evaluation drilling program and site operations and reclamation can be found in MMC's submittal, *Notification to Resume Suspended Exploration and Drilling Activities for the Montanore Project* (MMC 2006), on file with the lead agencies.

## 1.4 Proposed Action

The 2005 Plan of Operations is considered as a new Plan of Operations by the KNF because Noranda relinquished the federal authorization to construct and operate the Montanore Project in 2002. Both the KNF and the DEQ consider MMC's proposed 230-kV North Miller Creek transmission line to be part of the Proposed Action as the 1993 Certificate of Environmental Compatibility and Public Need for the 230-kV transmission line expired.

As proposed by MMC, the Montanore Project would consist initially of a 12,500-tons-per-day underground mining operation that would expand to a 20,000-tons-per-day rate. The surface mill would be located on National Forest System lands outside of the CMW in the Ramsey Creek drainage. The proposed project also would require constructing about 16 miles of high-voltage electric transmission line from a new substation adjacent to Bonneville Power Administration's (BPA) Noxon-Libby 230-kV Transmission Line to the project site. The Noxon-Libby 230-kV Transmission Line would be looped into the new ring bus substation named the Sedlak Park Substation at the tap point. BPA would design, construct, own, operate, and maintain the substation and loop line, and BPA's customer, Flathead Electric Cooperative, would provide power to MMC at that location. MMC would own and operate the 16-mile-long, 230-kV transmission line from the tap point to the project site. MMC's proposed 230-kV transmission line would be routed from the Sedlak Park Substation along U.S. 2, and then up the Miller Creek drainage to the project site. The location of the proposed project facilities is shown on Figure 2.

The ore body would be accessed from two adits adjacent to the mill. Two other adits, an evaluation/ventilation adit and a ventilation adit, both with entrances located on private land, also would be used during the project. The evaluation/ventilation adit would be located in the upper Libby Creek drainage; the ventilation adit would be located on MMC's private land (patented claim HR 134) in the upper East Fork Rock Creek drainage near Rock Lake.

The mineralized resource associated with the Montanore subdeposit is about 135 million tons. MMC anticipates mining up to 120 million tons. Ore would be crushed underground and conveyed to the surface mill located near the Ramsey Adits. Copper and silver minerals would be removed from the ore by a flotation process. Tailings from the milling process would be transported through a pipeline to a tailings impoundment located in the Little Cherry Creek drainage, about 4 miles from the proposed plant site.

Access to the mine and all surface facilities would be via U.S. 2 and the existing National Forest System road #278, the Bear Creek Road. (Road names and numbers are used interchangeably in this EIS; a complete list of all road names and numbers is in Appendix B.) MMC would upgrade 11 miles of the Bear Creek Road, and build 1.7 miles of new road between the Little Cherry Creek Impoundment Site and the Ramsey Plant Site. Silver/copper concentrate from the mill would be transported by truck to a rail siding in Libby, Montana. The concentrate would then be shipped by rail to an out-of-state smelting facility.

Mining operations would continue for an estimated 16 years once facility development was completed and actual mining operations started. Three additional years may be needed to mine 120 million tons. The mill would operate on a three-shifts-per-day, seven-days-per-week, year-long schedule. At full production, an estimated 7 million tons of ore would be produced annually during a 350-day production year. Employment numbers are estimated to be 450 people at full production. An annual payroll of $12 million is projected for full production periods.

As proposed, the mine operating permit area would be 3,628 acres and the disturbance area would be 2,582 acres. The operating permit area would include 443 acres of private land owned by MMC for the proposed mine and associated facilities. All surface disturbances would be outside the CMW. MMC has developed a reclamation plan to reclaim the disturbed areas following the phases associated with evaluation, construction, operation, and mine closure. MMC's proposal is described in section 2.4, *Alternative 2—MMC's Proposed Mine*.

With minor exceptions, MMC proposes to construct, operate, and reclaim a new mine and transmission line in accordance with the terms and conditions of DEQ Operating Permit #00150 and in accordance with the terms and conditions of the other agencies' permits and approvals issued to Noranda in 1992 and 1993. As indicated earlier, MMC and MMI have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC for modification to DEQ Operating Permit #00150, pursuant to ARM 17.24.119(3) (Klepfer Mining Service 2008a). The requested changes to DEQ Operating Permit #00150 are:

- Construction of an additional underground ventilation infrastructure that would result in an acre of disturbance on private land near Rock Lake
- Relocation of the concentrate loadout facility to the Kootenai Business Park located in Libby (private land) resulting in less than 1 acre of disturbance
- Installation of a buried powerline along the Bear Creek Road (NFS road #278), which would be reconstructed for access
- Construction of a temporary electrical substation adjacent to the Ramsey Creek Road (NFS road #4781), which would be reconstructed for access
- A change in the construction technique proposed for the Little Cherry Creek Impoundment from downstream to centerline construction

- Installation of a water pipeline from the Libby Adit to the LAD Areas

Other changes may be required to conform DEQ Operating Permit #00150 to the alternative selected by the KNF on the Montanore Project. MMC and the DEQ agreed to hold the request for modification to the permit in abeyance until completion of the environmental review process.

Each mine and transmission line alternative would require an amendment to the Kootenai Forest Plan (KFP) for the alternative to be consistent with the KFP. The amendment would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 and Forest Service Manual 1921.03. The analysis disclosed in this EIS satisfies the requirements for an evaluation for the amendment. The proposed KFP amendments are described in section 2.12, *Forest Plan Amendment*.

## 1.5 Purpose and Need

The following sections briefly describe the underlying purpose and need to which each major permitting agency (KNF, DEQ, BPA, and Corps) is responding in proposing the alternatives, including the Proposed Action (40 CFR 1502.13). MMC's project purpose and need is discussed in section 1.5.5, *Montanore Minerals Corporation*. Purpose(s) and need(s) are used to define the range of alternatives analyzed in the EIS. Each agency's statutory authorities and policies determine its underlying purpose and need. The KNF's and DEQ's overall purpose and need is to process MMC's Plan of Operations, application for a modification to DEQ Operating Permit #00150, application for a transmission line certificate of compliance, and other permit applications, and to follow all applicable laws, regulations, and policies pertaining to each pending application. The BPA's need is to improve its transmission system to ensure continued reliable electric power to its customers, and its purposes are to minimize costs while meeting BPA's long-term system planning objectives for the area, and to minimize impacts to the human environment through site selection and design.

### 1.5.1 Kootenai National Forest

As discussed previously, the Forest Service verified in 1985 that valid rights to the minerals patented on HR 133 and HR 134 claims have been established within the CMW. Those rights are currently held by MMC. The role of the KNF under its primary authorities in the Organic Administration Act, Locatable Regulations 36 CFR 228 Subpart A, and the Multiple Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System lands and comply with all applicable environmental laws. The KNF has no authority to unreasonably circumscribe or prohibit reasonably necessary activities under the General Mining Law that are otherwise lawful. Through the Mining and Mineral Policy Act, Congress has stated it is the continuing policy of the federal government, in the national interest, to foster and encourage private enterprise in:

- The development of economically sound and stable domestic mining, minerals, and metal and mineral reclamation industries
- The orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs

MMC is asserting its right under the General Mining Law to mine the mineral deposit and remove the copper and silver, subject to regulatory laws. From the perspective of the Forest Service, the need is to:

- Respond to MMC's proposed Plan of Operations to develop and mine the Montanore copper and silver deposit
- Ensure the selected alternative would comply with other applicable federal and state laws and regulations
- Ensure the selected alternative, where feasible, would minimize adverse environmental impacts on National Forest System surface resources
- Ensure measures would be included, where practicable, that provide for reclamation of the surface disturbance

### 1.5.2 U.S. Army Corps of Engineers

In accordance with the Clean Water Act, the Corps is required to consider and express the activity's underlying purpose and need from the applicant's and public's perspectives (33 CFR 325). From the Corps' perspective, the underlying project purpose is to provide copper and silver from deposits contained in northwestern Montana in an economically viable manner to meet a portion of current and future public demands. Over the past decade, global demand for copper and silver generally has been on an upward trend. MMC proposes to mine about 120 million tons of ore at an average grade of 1.93 ounces of silver per ton of ore and 15 pounds of copper per ton. The proposed project would partially fulfill society's demand for these commodities. The following sections discuss the demand and supply for copper and silver.

Because of its properties of thermal and electrical conductivity, malleability, and resistance to corrosion, copper has become a major industrial metal, ranking third after iron and aluminum in terms of quantities consumed. In 2007, building construction was the single largest market for copper, followed by electric and electronic products, transportation equipment, consumer and general products, and industrial machinery and equipment (USGS 2008). Copper byproducts from manufacturing and obsolete copper products are readily recycled and contribute significantly to copper supply. Worldwide use of copper has increased substantially over the past 10 years. World refined copper production was an estimated 15.6 million metric tons in 2007 (USGS 2008), about 4.3 million metric tons more than in 1997 (USGS 1998). The U.S. produced 1.2 million metric tons in 2007. China remained the largest user, which increased copper consumption by 37 percent in the first half of 2007 (USGS 2008).

In 2007, the principal domestic mining states, in descending order of production—Arizona, Utah, New Mexico, Nevada, and Montana—accounted for 99 percent of domestic copper production; copper also was recovered at mines in two other states. The U.S. produced 1.2 million metric tons in 2007, and relied on imports for 37 percent of its copper consumption in 2007 (USGS 2008).

Of all the metals, pure silver has the whitest color, the highest optical reflectivity, and the highest thermal and electrical conductivity. Demand for silver is generated by three primary uses: industrial and decorative uses, photography, and jewelry and silverware. Together, these three categories represent more than 95 percent of annual silver consumption. The dominant use for silver is in industrial applications, which increased worldwide from 319 million troy ounces in 1997 to 430 million troy ounces in 2006. Decreased photographic uses moderated total worldwide

silver demand, which increased from 836 million troy ounces in 1997 to 912 million troy ounces in 2006 (The Silver Institute 2007). The deficit in world silver production was about 26 million troy ounces in 2006 (USGS 2008).

Mine production of silver in the U.S. over the past decade peaked in 1998 at 66 million troy ounces (USGS 2001), decreasing to 37 million troy ounces in 2006 (USGS 2008). In 2007, Alaska and Nevada were the leading U.S. silver producers. The U.S. imported 147 million troy ounces of silver in 2007 (USGS 2008), up significantly from the 107 million troy ounces imported in 1998 (USGS 2001). In 2008, 55 percent of the U.S. silver consumption was met with imports (USGS 2008).

### 1.5.3 Bonneville Power Administration

The BPA is a federal power marketing agency that owns and operates more than 15,000 circuit miles of transmission lines in the Pacific Northwest. The transmission lines carry most of the high voltage (230-kV and above) from the resources of the federal Columbia River Power system and other interconnected private and federal projects. BPA's customers include publicly owned power marketers (public utility districts), municipalities, investor-owned utilities, and large direct service industries. The utility customers, in turn provide electricity to industry, homes, businesses, and farms.

BPA's transmission system in northwestern Montana provides reliable power to BPA's customers. BPA has a need therefore to improve its transmission system to ensure continued reliable electrical power for all of its customers. BPA's purposes are goals to be achieved while meeting the need for the project; the goals are used to evaluate the alternatives proposed to meet the need. Therefore, BPA will use the following purposes to choose among the alternatives:

- Increase BPA system capacity while maintaining BPA transmission system reliability
- Maintain environmental quality
- Minimize impacts to the human environment through site selection and design
- Minimize costs while meeting BPA's long-term transmission system planning objectives for the area

### 1.5.4 Montana Department of Environmental Quality

The MEPA and its implementing rules, ARM 17.4.201 *et seq.*, require that EISs prepared by state agencies include a description of the purpose and benefits of the proposed project. MMC's project purpose is described in section 1.5.5, *Montanore Minerals Corporation*. Benefits of the proposed project include the production of copper and silver to help meet public demand for these minerals. The project would increase employment and tax payments in the project area. Employment and taxes are addressed in section 3.17, *Social/Economics*. Although the proposed project would help meet public demand for copper and silver, that topic is outside the scope of this EIS and is not addressed in Chapter 3.

The MFSA and an implementing rule, ARM 17.20.920, require that an application for an electric transmission line contains an explanation of the need for the facility. No electrical distribution system is near the project area. The nearest electrical distribution line parallels U.S. 2 and it is not adequate to carry the required electrical power. As discussed in Chapter 2, the lead agencies

considered, but eliminated from detailed analysis, alternatives other than a new transmission line. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

### 1.5.5 Montanore Minerals Corporation

MMC's project purpose is to develop and mine the Rock Lake copper and silver deposit by underground mining methods with the expectation of making a profit. MMC's need is to receive all necessary governmental authorizations to construct, operate, and reclaim the proposed Montanore Mine, the associated transmission line, and other incidental facilities. MMC proposes to construct, operate, and reclaim the Montanore Project in an environmentally sound manner, subject to reasonable mitigation measures designed to avoid or minimize environmental impacts to the extent practicable.

## 1.6 Agency Roles, Responsibilities, and Decisions

Two "lead" agencies have been designated for this project: the KNF and the DEQ. A single Draft EIS for the Montanore Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. Before construction and operation of the proposed project could begin, various other permits, certificates, licenses, or approvals will be required from the two lead agencies and other agencies (see Table 1 at the end of this chapter). Table 1 is not a comprehensive list of all permits, certificates, or approvals needed, but lists the primary federal, state, and local agencies with permitting responsibilities. The roles and responsibilities of the agencies with primary environmental permitting and regulatory responsibilities are discussed in the following sections.

The major decisions to be made by the lead agencies and by other agencies are discussed briefly in this section. Federal and state agency decision-making is governed by regulations. Each agency's regulations provide the conditions that the project must meet to obtain the necessary permits, approvals, or licenses and provide the conditions under which the agency could deny MMC the necessary permits or approvals.

### 1.6.1 Federal Agencies

#### 1.6.1.1 Kootenai National Forest

##### *1.6.1.1.1 Applicable Laws and Regulations*

Most of the proposed permit areas would be on National Forest System lands managed by the KNF. The KNF is obligated under certain laws, regulations, and 1987 KFP direction to evaluate and take action on MMC's request to operate a mine, mill, and auxiliary facilities on National Forest System lands and associated private lands. The applicable major laws are summarized below:

- The 1872 General Mining Law gives U.S. citizens the right to explore, locate mining claims, make discoveries, patent claims, and develop mines on National Forest System lands open to mineral entry.
- The Organic Act authorizes the KNF to regulate mineral operations on National Forest System lands and to develop mineral regulations at 36 CFR 228, Subpart A. These regulations require that a proposed Plan of Operations be submitted for activities that could result in significant disturbance to surface resources.

- The Multiple Use Mining Act affirms that unpatented mining claims may be used for prospecting, mine processing, and uses reasonably incident thereto.
- The Wilderness Act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as prior to the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights.
- The Alaska National Interest Lands Conservation Act directed the KNF to provide access to non-federally-owned land (which includes patented claims and private mineral estates) within the boundaries of National Forest System lands, allowing landowners reasonable use and enjoyment of their property.
- The KFP management direction is to encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation (KFP Vol. 1, II-2, # 11). The objective of the KFP for mining activities is to encourage mineral development under the appropriate laws and regulations and according to the direction established by the plan (KFP Vol. 1, II-8, Locatables).

Forest Service regulations (36 CFR 228, Subpart A) apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. Operations are defined as all functions, work, and activities in conjunction with prospecting, exploration, development, mining or processing of mineral resources, and all uses reasonably incident thereto, including roads and other means of access on lands subject to the regulation in this part, regardless of whether said operations take place on or off mining claims (36 CFR 228.3(a)). Special use permits may be needed if proposed facilities would not be owned or operated by the operator (MMC) or if facilities would remain in place after mining operations are completed, such as a transmission line, radio facilities, and weather stations. Regulations for special uses on National Forest System lands are contained in 36 CFR 251. Both sets of regulations require that an applicant describe the proposed operation, environmental protection measures, and reclamation plans.

The KNF would share responsibility with the DEQ to monitor and inspect the Montanore Project, and has authority to approve the Plan of Operations that includes all the necessary modifications to ensure that impacts to surface resources would be minimized. The KNF and the DEQ would collect a reclamation bond from MMC to ensure that the lands involved with the mining operation are properly reclaimed. The joint reclamation bond would be held by the DEQ to ensure compliance with the reclamation plan associated with the operating permit and the Plan of Operations, as stipulated in a 1989 Memorandum of Understanding between the Forest Service-Northern Region and the DSL. The KNF may require an additional bond if it determined that the bond held by the DEQ were not adequate to reclaim National Forest System lands or were administratively unavailable to meet KNF requirements. The KNF and the DEQ would collect a reclamation bond for National Forest System lands affected by the transmission line. The DEQ would collect a reclamation bond for private lands affected by the transmission line.

The KNF is required by the National Forest Management Act to provide for the diversity of plant and animal communities. KFP standards for wildlife state that the maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, will be attained through the maintenance of a diversity of plant communities and habitats. It is Forest Service policy (FSM 2670) that biological evaluations (BE) be

conducted to determine potential effects on sensitive species. If the BE identifies any significant effects that would result in a loss of species viability or create a significant trend toward federal listing, the KNF Supervisor could not issue the permits that would allow the project to proceed.

The KNF is required by the Endangered Species Act (ESA) to ensure that any actions it approves will not jeopardize the continued existence of a threatened or endangered (T&E) species or result in the destruction or adverse modification of critical habitat. The KNF will prepare a biological assessment (BA) that evaluates the potential effect of the proposed project on T&E species, including measures the KNF believes are needed to minimize or compensate for effects. The KNF will submit the BA to the U.S. Fish and Wildlife Service (USFWS) for review and consultation.

Federal agencies have government-to-government responsibilities to consult with federally recognized American Indian Tribes. Among those tribes are the Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho who have retained off reservation treaty rights in the project area through the Hellgate Treaty of 1855. The responsibilities of the KNF regarding tribal consultation are found in the following laws, treaties, and executive orders:

- Hellgate Treaty of 1855
- National Historic Preservation Act
- National Environmental Policy Act
- National Forest Management Act
- American Indian Religious Freedom Act
- Archaeological Resources Protection Act
- Native American Graves Protection and Repatriation Act
- Religious Freedom Restoration Act
- Interior Secretarial Order 3175
- Executive Orders 12866, 12898, 13007, and 13084

##### *1.6.1.1.2 Decision*

The KNF Supervisor will issue a decision on MMC's proposal in a ROD. The decision objective is to select an action that meets the legal rights of MMC, while protecting the environment in compliance with applicable laws, regulations, and policy. The KNF Supervisor will use the EIS process to develop the necessary information to make an informed decision as required by 36 CFR 228, Subpart A. Based on the alternatives developed in the EIS, the KNF will issue a ROD in which one of the following decisions will be made:

- Approval of the Plan of Operations as submitted
- Approval of the Plan of Operations with changes, and the incorporation of mitigations and stipulations that meet the mandates of applicable laws, regulations, and policy
- Notification to MMC that the KNF Supervisor will not approve the Plan of Operations until a revision to the proposed Plan of Operations that meets the mandates of applicable laws and regulations is submitted

The alternative selected by the KNF must meet the purpose of the Forest Service locatable mineral surface management regulations as described in 36 CFR 228, Subpart A and the Mining and Minerals Policy Act.

### 1.6.1.2 U.S. Fish and Wildlife Service

#### *1.6.1.2.1 Applicable Laws and Regulations*

The USFWS has responsibilities under the Fish and Wildlife Coordination Act, Endangered Species Act, Migratory Bird Treaty Act, and Bald Eagle Protection Act.

#### *1.6.1.2.2 Decision*

The USFWS will decide if implementation of the project would jeopardize the continued existence of any species listed or proposed as T&E under the ESA, or adversely modify critical or proposed critical habitat, based on a BA prepared by the KNF. The USFWS' decision is documented in a Biological Opinion (BO). If the USFWS issues a "jeopardy" or "adversely modify" opinion in the BO, the USFWS would describe reasonable and prudent alternatives, if available, that would avoid jeopardizing the continued existence of T&E species, or adversely modifying critical or proposed critical habitat.

The BO will include "terms and conditions" that MMC must comply with. In addition, the BO will include "conservation recommendations" for discretionary activities to minimize or avoid adverse effects of the Proposed Action on listed species or critical habitat. The USFWS has 135 days from initiation of formal consultation (defined as the acceptance of KNF's BA as complete) to render its BO.

### 1.6.1.3 U.S. Army Corps of Engineers

#### *1.6.1.3.1 Applicable Laws and Regulations*

MMC's construction of certain project facilities in waters of the U.S., including wetlands and other special aquatic sites, would constitute the disposal of dredged or fill materials. Such activities require a permit from the Corps under Section 404 of the Clean Water Act. The Corps will request 401 certification from the DEQ (see section 1.6.2.1, *Montana Department of Environmental Quality*), and has the authority to take reasonable measures to inspect Section 404-permitted activities (33 CFR 326.4).

The Corps and the Environmental Protection Agency (EPA) have developed guidelines to evaluate impacts from the disposal of dredged or fill material on waters of the U.S. and to determine compliance with Section 404 of the Clean Water Act (40 CFR 230). The guidelines require analysis of "practicable" alternatives that would not require disposal of dredged or fill material in waters of the U.S., or that would result in less environmental damage. In the guidelines, the term "practicable" is defined as "available or capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." The Corps can only permit the least environmentally damaging, practicable alternative.

#### *1.6.1.3.2 Decision*

The Corps will decide whether to issue a 404 permit based on MMC's 404 permit application. MMC will submit a Section 404 permit application to the Corps for the preferred alternative identified by the lead agencies. The application will describe the amount and types of wetlands and other waters of the U.S. that would be affected by proposed facilities. The diversion of Little

Cherry Creek, if a part of the preferred alternative, would be covered by the 404 permit. The permit application also will include detailed plans to mitigate impacts to wetlands and other waters of the U.S. The Corps will issue a ROD on its permit decision. The Corps can deny a Section 404 permit if the project would not comply with the 404(b)(1) guidelines (40 CFR 230.10), or if the permit issuance would be contrary to the public interest (33 CFR 320.4). If the Corps decides to issue a Section 404 permit, it will issue a ROD concurrently with the permit.

#### 1.6.1.4 Bonneville Power Administration

##### *1.6.1.4.1 Applicable Laws and Regulations*

A number of federal laws and regulations address open access to BPA's transmission system, including (i) the Bonneville Project Act of 1937, which gives preference and priority in power sales to public bodies and cooperatives; (ii) the Flood Control Act of 1944, which specifies that the Secretary of the Interior (now the Secretary of the Energy) must transmit and dispose of power/energy in a way that encourages widespread use of the power/energy and is sold at the lowest possible rates consistent with sound business principles; (iii) the Pacific Northwest Power Act, which requires BPA "whenever requested" to meet the net requirements of Northwest utilities; and (iv) the Columbia River Transmission System Act of 1974 (the Transmission System Act), which requires the administrator of the BPA to make available to all utilities on a fair and nondiscriminatory basis transmission system capacity not needed to transmit federal power. The BPA would provide a 230-kV power source from its Noxon-Libby 230-kV Transmission Line to its customer Flathead Electric Cooperative at the proposed Sedlak Park Substation. The BPA is prohibited from providing power directly to the project. The BPA would design construct, own, operate, and maintain the substation, which would be paid for by MMC. The substation would be located at Sedlak Park.

##### *1.6.1.4.2 Decision*

Before deciding to provide electrical power to Flathead Electric Cooperative for MMC's project, the BPA will prepare a decision document for its part of the project. The BPA can deny approval for the electrical transmission line connection if significant environmental impacts at the connection location would occur, or if the interconnected electrical system would not allow adequate service to the mine and existing electrical customers if the mine were approved.

#### 1.6.1.5 Environmental Protection Agency

The EPA has responsibilities under the Clean Air Act to review Draft EISs and federal actions potentially affecting the quality of the environment. The EPA will evaluate the adequacy of information in this Draft EIS, and the overall environmental impact of the Proposed Action and alternatives. The EPA also reviews 404 permit applications and provides comments to the Corps, and has veto authority under the Clean Water Act for decisions made by the Corps on 404 permit applications. The EPA has oversight responsibility for Clean Water Act programs delegated to and administered by the DEQ. The EPA may also intervene to resolve interstate disputes if discharges of pollutants in an upstream state may affect water quality in a downstream state.

### 1.6.2 State and County Agencies

#### 1.6.2.1 Montana Department of Environmental Quality

##### *1.6.2.1.1 Applicable Laws and Rules*

The Montana legislature has passed statutes and the Board of Environmental Review has adopted administrative rules defining the requirements for construction, operation, and reclamation of a mine and transmission line, discharge of mining waters, discharge of emissions, storage of hazardous and solid wastes, and development and operation of public water supply and sewer systems. The DEQ is required to evaluate the operating permit modification, certificate, and license applications submitted by MMC under the following major laws and regulations:

- MEPA requires the state to conduct an environmental review when making decisions or planning activities that may have a significant impact on the environment. The MEPA and its rules define the process to be followed when preparing an environmental assessment (EA) or an EIS.
- The Montana Metal Mine Reclamation Act (MMRA) requires an approved operating permit for all mining activities that have more than 5 acres of land disturbed and unreclaimed at any one time. The MMRA sets forth reclamation standards for lands disturbed by mining, generally requiring that they be reclaimed to comparable stability and utility as that of adjacent areas. The MMRA describes the process by which a minor revision or a major amendment to an approved operating permit is reviewed and processed. MMC must also obtain the necessary or modify any existing air and water quality permits. Mines that would have more than 75 employees must also have a valid approved Hard Rock Mining Impact Plan prior to operations.
- MFSA requires the DEQ to issue a certificate of compliance before construction of certain major facilities, such as the proposed transmission line. Prior to certification of the proposed transmission line, MMC must also obtain the necessary air and water quality permits.
- The Montana Water Quality Act, through MPDES permits, regulates discharges of pollutants into state surface waters through a permit application process and the adoption of water quality standards. Water quality standards, including the Montana nondegradation policy, specify the changes in surface water or ground water quality that are allowed from a waste water discharge. A MPDES permit may also include limits for discharges of storm water and will require the development of a storm water pollution prevention plan.
- The Clean Air Act of Montana requires a permit for the construction, installation, and operation of equipment or facilities that may cause or contribute to air pollution.
- The federal Clean Water Act requires that applicants for federal permits or licenses for activities that may result in a discharge to state waters obtain certification from the state, certifying the discharge complies with state water quality standards. Section 404 permits issued by the Corps require 401 certification. The DEQ provides Section 401 certification pursuant to state regulations.

- The Montana Public Water Supply Act regulates public water supply and sewer systems that regularly serve at least 25 persons daily for a period of at least 60 calendar days a year. The DEQ must approve plans and specifications for water supply wells in addition to water systems or treatment systems and sewer systems. Operators for community public water supply, waste water treatment, or sewer systems must be certified by the DEQ.
- The Montana Hazardous Waste Act and the Solid Waste Management Act regulate the storage and disposal of solid and hazardous wastes.

#### *1.6.2.1.2 Decision*

DEQ's authority to impose modifications or mitigations without the consent of MMC is limited to modifications necessary for compliance with the MMRA, Montana Water Quality Act, Clean Air Act of Montana, or other state environmental regulatory statutes or rules adopted pursuant to those statutes. The DEQ can impose modifications to the proposed transmission line without MMC's consent under MFSA in accordance with 75-20-301, MCA. Grounds for DEQ denial of the application to modify DEQ Operating Permit #00150 would be a finding that the modification does not provide an acceptable method for accomplishing the reclamation required by the MMRA, or that it conflicts with Montana water and air quality laws. The DEQ may deny the application for a transmission line certificate of compliance if the findings required under 75-20-301 cannot be made.

**Compliance with MEPA**

The DEQ and the KNF have entered into an agreement describing how each agency will cooperate to fulfill the requirements of MEPA and NEPA. No decision is made under MEPA. The Draft EIS is a disclosure document. All DEQ decisions are made pursuant to specific regulatory requirements. The DEQ will issue a ROD or certificate containing its decisions pursuant to each project-related permit application. In general, for an application for an operating permit modification and a transmission line certificate of compliance, three decisions are possible:

- Approval of the application as submitted
- Approval of the application, and the incorporation of mitigations and stipulations that meet the mandates of applicable laws, regulations, and policy
- Denial of the application

**Hard Rock Operating Permit**

The DEQ Director may make a decision on MMC's application for a modification to DEQ Operating Permit #00150 no sooner than 15 days following publication of the Final EIS. The DEQ may deny the application pursuant to 82-4-351, MCA, if the proposed mine or reclamation plan modification conflicted with the Clean Air Act of Montana, the Montana Water Quality Act, or reclamation standards set forth in the MMRA. The DEQ may also deny the modification based on the compliance standard of an applicant under 82-4-336 and 360, MCA. These sections of the MMRA require permittees to be in compliance at other sites they may have permitted under MMRA, require submittal of ownership and control information, and submittal of an adequate bond.

### Transmission Line Certificate of Compliance

For MMC's proposed transmission line, MFSA requires the DEQ Director to determine:

- The basis of the need for the facility
- The nature of the probable environmental impact
- That the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives
- In the case of an electric, gas, or liquid transmission line or aqueduct:
    - What part, if any, of the line or aqueduct will be located underground
    - That the facility is consistent with regional plans for expansion of the appropriate grid of the utility systems serving the state and interconnected utility systems
    - That the facility will serve the interests of utility system economy and reliability
- That the location of the facility as proposed conforms to applicable state and local laws and regulations, except that the DEQ may refuse to apply any local law or regulation if it finds that, as applied to the proposed facility, the law or regulation is unreasonably restrictive in view of the existing technology, of factors of cost or economics, or of the needs of consumers, whether located inside or outside the directly affected government subdivisions
- That the facility will serve the public interest, convenience, and necessity
- That the DEQ or board has issued any necessary air or water quality decision, opinion, order, certification, or permit as required by 75-20-216(3)
- That the use of public lands for location of the facility was evaluated and public lands were selected whenever their use is as economically practicable as the use of private lands

The DEQ requires reclamation of disturbed areas and may require bonds to ensure adequate reclamation. DEQ's decision on the transmission line must be made within 30 days after the final report (Final EIS) is released or may be timed to correspond to the ROD issued by a participating federal agency.

The DEQ must deny certification for a project if the findings in 75-20-301, MCA, or implementing regulations cannot be made or if the transmission line would violate Montana air or water quality standards, based on the DEQ analysis. Without the approval of the mine by the KNF, MMC would likely withdraw the transmission line application because there would not be a demonstrated showing of need for the transmission line. The DEQ may disapprove the transmission line, regardless of actions by other agencies. After issuance of the certificate, any other state or regional agency or municipality or other local government may not require any approval, consent, permit, certificate, or other condition for the construction, operation, or maintenance of a facility except that the DEQ and board retain the authority that they have to determine compliance of the proposed facility with state and federal standards and implementation plans for air and water quality.

### Water Quality Permits

***MPDES Permit.*** Waste water discharges, including storm water runoff, from the project site must be included in MMC's current MPDES permit issued by the DEQ. All Montanore facilities must be designed, constructed, and operated to prevent degradation of surface water or ground water

quality beyond that allowed by and specified in the BHES Order (Appendix A). The DEQ will follow EPA Region 8 guidance when determining types of wastewater as “process,” “mine drainage,” or “stormwater.” The DEQ would use both Technology-Based Effluent Limits (TBEL) and Water Quality-Based Effluent Limits (WQBEL) in MPDES permit development or modification. The more stringent of the two, TBEL or WQBEL, would be applied for each specific parameter and would be the final effluent limit for parameters of concern in the discharge. The DEQ must also consider mixing zone applicability and Total Maximum Daily Loads (TMDL) when applicable.

***401 Certification.*** The DEQ has 30 days to review the Corps’ Section 404 permit application and supplemental materials and determine whether to provide a 401 certification (with or without added DEQ conditions), deny the certification, or to request more information. The DEQ may deny the certification if the discharge would result in a violation of Montana water quality standards. The DEQ may also waive certification if the project would cause minimal effects to state waters or it determines that an MPDES permit is required.

***318 Exemption (formerly 3A Waiver).*** A short-term exemption from surface water quality standards for turbidity may be authorized by the DEQ for construction of the powerline, access roads, the tailings impoundment, and other stream crossings (75-5-318, MCA).

#### Air Quality Permit

The DEQ will decide whether to issue an Air Quality Permit to control particulate emissions of more than 25 tons per year. When an environmental review is completed on the permit application, the final permit or determination may be included in the Final EIS, the ROD, or issued within 180 days after the permit is ruled complete.

#### Public Water Supply and/or Public Sewer System Authorization

The DEQ will decide on issuance of a public water supply and/or public sewer system authorization. This program is responsible for assuring that the public health is maintained through a safe and adequate supply of drinking water. If the public water supply and/or sewer systems w not constructed within 3 years of authorization, a new application must be submitted.

#### Hazardous Waste Generator/Transporter Permit

The DEQ has adopted hazardous waste regulations that are equivalent to those promulgated by EPA. The DEQ will decide on issuing a permit for generators and transporters of hazardous waste for the Montanore Project. The permit review considers the applicant’s record of complaints and convictions for the violation of environmental protection laws for 5 years before the date of the application. The DEQ would consider the number and severity of the violations, the culpability and cooperation of the application, and other factors. Annual registration is required.

### 1.6.2.2 Montana State Historic Preservation Office

The State Historic Preservation Office (SHPO) advises federal and state agencies when a proposed project could affect eligible or potentially eligible historic properties (historic and prehistoric sites). The SHPO provides federal and state agencies with opinions on all historic properties’ eligibility for listing in the National Register of Historic Places. SHPO also provides comments on the determination of effect on eligible historic properties by the Proposed Action The KNF, the DEQ, and the SHPO will concur that the proposed project will have: 1) no effect; 2) no adverse effect; or 3) adverse effect on eligible historic properties. The lead agencies would

require MMC to implement any protection, mitigation, and monitoring in plans reviewed and approved by the SHPO and possibly the Advisory Council on Historic Preservation.

### 1.6.2.3 Montana Hard Rock Mining Impact Board

The Hard Rock Mining Impact Act (90-6-301 *et seq.*, MCA) is designed to assist local governments in handling financial impacts caused by large-scale mineral development projects. A new mineral development may result in the need for local governments to provide additional services and facilities before mine-related revenues become available. The resulting costs can create a fiscal burden for local taxpayers. The Hard Rock Mining Impact Board (HRMIB), part of the Montana Department of Commerce (DOC), oversees an established process for identifying and mitigating fiscal impacts to local governments through the development of a Hard Rock Mining Impact Plan. Under the Impact Act, each new hard rock mineral development in Montana that would have more than 75 employees is required to prepare a local government fiscal Impact Plan. In the plan, the developer is to identify and commit to pay all increased capital and net operating costs to local government units that will result from the mineral development. A Hard Rock Mining Impact Plan developed for the original Montanore Project was approved in the early 1990s, and that approval was acquired by MMC when it acquired Noranda. Because the Montanore Project as currently proposed would change employment projections, MMC submitted an amendment for consideration by the HRMIB. The HRMIB approved the amendment in 2008.

### 1.6.2.4 Montana Department of Natural Resources and Conservation

#### *1.6.2.4.1 Applicable Laws and Regulations*

The DNRC administers the following statutes and regulations that pertain to MMC's proposed mine and transmission line:

- The Montana Water Use Act requires a water rights permit for the diversion of surface water or use of ground water in excess of 35 gpm or more than 10 acre-feet of water annually.
- Except for the transmission line, the Montana Floodplain and Floodway Management Act requires a permit for new construction within a designated l00-year floodplain.
- A Montana land-use license or easement on navigable waters is required for any project on lands below the low water mark of navigable waters.
- The Streamside Management Zone requirements apply to any landowner or operator conducting a series of forest practices that will access, harvest, or regenerate trees on a defined land area for commercial purposes on private, state, or federal lands. Timber harvest is prohibited within 50 feet of any stream, lake, or other body of water.
- Except for the transmission line, a burning permit must be obtained from the DNRC to burn any slash or other material outside the open burning season of October 10 to November 31 and April 1 to May 31.
- The Conservation Districts Bureau of the DNRC administers the Montana Natural Streambed and Land Preservation Act. Any non-governmental entity that proposes to work in or near a stream on public or private land requires a 310 permit for any activity that physically alters or modifies the bed or banks of a perennially flowing stream.

- The Montana Dam Safety Act applies to the construction, repair, operation, and removal of any dam that impounds 50 acre-feet or more at normal operating pool level. This permit will not apply during mine operation, but may apply after mine closure if other safety criteria are not met.

##### *1.6.2.4.2 Decision*

**Water Use Permit**

The DNRC will decide on issuance of a water use permit based on criteria set forth in 85-2-308, MCA. Denial of the permit must follow 85-2-310 (2), MCA. A person having standing to file an objection may do so pursuant to 85-2-308, MCA. Valid objections received by the DNRC pursuant to 85-2-309, MCA, may require that the DNRC hold a contested case hearing pursuant to 2-4-601 *et al.*, MCA, on the objection within 60 days from a date set by the DNRC. A person who has exhausted all administrative remedies available within the DNRC and who is aggrieved by a final written decision in a contested case is entitled to judicial review pursuant to 2-4-702, MCA.

**Floodplain and Floodway Management Permit**

The local floodplain administrator or the DNRC would make a decision on the permit application. The application process may take up to 60 days.

**DNRC Land Use License or Easement**

The DNRC will review the application, conduct a field investigation if necessary, and file an environmental action checklist. A written report and recommendation is then submitted to the Special Use Management Bureau, which makes the final determination and recommends stipulations as necessary. A Land Use License can normally be reviewed, approved, and issued within 60 days upon the payment of the application fee and a minimum annual rental fee set by the DNRC. The license may be held for a maximum period of 10 years, with the ability to request renewal for an additional 10 years. An easement requires approval from the Board of Land Commissioners, which typically takes up to 90 days.

**Streamside Management Zone**

MMC must comply with the streamside management practices found in 77-5-303, MCA, or submit a request to conduct an alternative practice to the DNRC. Within 10 working days of receipt of the application for approval of alternative practices, the DNRC will determine if the application is approved, approved with modification, disapproved, incomplete, requires additional information or environmental analysis, or requires a field review. If a field review is required, the DNRC will make a decision on the application within 10 days of completing the field review.

**Burning Permit**

The DNRC Burning Permit outside the open burning season depends on air quality standards set by the DEQ. Review and issuance of the permit is done in coordination with the DEQ and depends on the air quality at the time of the request.

**310 Permit**

Except for streams associated with the transmission line, the Lincoln County Conservation District of the DNRC must receive a 310 permit application from a non-governmental or private entity prior to activity in or near a perennial-flowing stream. Once an application is accepted, a

team that consists of a conservation district representative, a biologist with the Montana Fish, Wildlife and Parks (FWP), and the applicant may conduct an onsite inspection. The team makes recommendations to the Conservation District Board, which has 60 days from the time the application is accepted to approve, modify, or deny the permit.

**High Hazard Dam Permit**

DNRC will not be issuing a high hazard dam permit for the tailings impoundment because management and operation of the impoundment would be addressed under an MMRA operating permit during operations. The DEQ intends that MMC's proposed impoundment meet high hazard dam safety requirements including the preparation of an Operations and Maintenance Plan and Emergency Preparedness Plan that meets DNRC requirements, if the impoundment qualifies as such, so that the transition to regulation under DNRC's permit would be facilitated at mine closure.

#### 1.6.2.5 Montana Fish, Wildlife and Parks

The FWP is responsible for the use, enjoyment, and scientific study of the fish in Libby Creek and other project area creeks. FWP's approval, and designation of a licensed collector as field supervisor, would be required for monitoring, mitigation, and transplanting of the fish within the project area. The FWP also administers applicable portions of the Stream Protection Act and cooperates with the DEQ in water quality protection.

The FWP also holds a conservation easement on some lands owned by Plum Creek Timber Company (Plum Creek) where the transmission line may be sited. Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek or other owner and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless the prior written approval is given by the FWP.

#### 1.6.2.6 Montana Department of Transportation

The MDT is responsible for the safe operation of the state-owned highways and transportation facilities, such as U.S. 2. The MDT is responsible for approving approach roads onto state-owned highways. MDT is also responsible for approving utilities occupancy within MDT rights-of-way. The MDT reserves the right to modify or deny applications if the design puts the traveling public, the state highway system, or transportation facilities at risk.

#### 1.6.2.7 Lincoln County Weed Board

The Lincoln County Weed Board administers the County Noxious Weed Control Act for any land-disturbing activities within its jurisdiction. MMC is required to submit a weed management plan to the Lincoln County Weed Board for approval.

**Table 1. Permits, Licenses, and Approvals Required for the Montanore Project.**

| Permit, License, or Approval | Purpose |
|---|---|
| **Kootenai National Forest** | |
| Approval of Plan of Operations (36 CFR 228, Subpart A) | To allow MMC to explore, construct and operate a mine and related facilities on National Forest System lands. Approval incorporates management requirements to minimize or eliminate effects on other surface resources that include final design of facilities, and mitigation and monitoring plans as described in the ROD. Review of the proposed plans is coordinated with the DEQ and other appropriate agencies. Approval of the Plan of Operations is contingent on MMC accepting and incorporating the terms and conditions (as listed in the ROD) into the Plan of Operations. |
| Special Use Permit(s) (36 CFR 251) | To allow utility companies to construct and operate electric transmission/distribution and telephone lines and to allow MMC to construct and maintain associated facilities such as a weather station or radio tower that may remain on National Forest System lands after completion of the mining operation. |
| Road Use Permit | To specify operation and maintenance responsibilities on National Forest Service roads not covered by the Plan of Operations. |
| Mineral Material Permit | To allow MMC to take borrow material from National Forest System lands outside mining claims or mill sites. |
| Timber Sale Contract | To allow MMC to harvest commercial timber from the project area within National Forest System lands. Harvesting would be conducted to clear the area for project facilities. |
| Approval of Noxious Weed Management Plan | To allow MMC to perform work identified in the Noxious Weed Management Plan to minimize noxious weed propagation. |
| **U.S. Fish and Wildlife Service** | |
| Biological Opinion | To protect T&E species and any designated critical habitat. Consultation with the KNF. |
| 404 Permit Review | To comment on the 404 permit to prevent loss of, or damage to, fish or wildlife resources. Consultation with the Corps. |
| **U.S. Army Corps of Engineers** | |
| 404 Permit (Clean Water Act) | To allow discharge of dredged or fill material into wetlands and waters of the U.S. Subject to review by the EPA, the USFWS, the KNF, and the DEQ. Coordinate with the SHPO. |

| Table 1. Permits, Licenses, and Approvals Required for the Montanore Project (cont'd). | |
|---|---|
| **Permit, License or Approval** | **Purpose** |
| **Montana Department of Environmental Quality** | |
| Hard Rock Operating Permit Modification (MMRA) | To allow a change in an approved operating plan. Proposed activities must comply with state environmental standards and criteria. Approval may include stipulations for final design of facilities and monitoring plans. A sufficient reclamation bond must be posted with the DEQ before implementing an operating permit modification. Coordinate with the KNF. |
| Transmission Line Certificate (MFSA) | To allow the construction and operation of a 230-kV transmission line more than 10 miles long. Reclamation plans and bond can be required. Coordinate with the KNF, the FWP, the Montana Department of Transportation, the DNRC, the DOC, the Montana Department of Revenue, and the Montana Public Service Commission. |
| Air Quality Permit (Clean Air Act of Montana) | To control particulate emissions of more than 25 tons per year. |
| MPDES Permit (Montana Water Quality Act) | To establish effluent limits, treatment standards, and other requirements for point source discharges, including storm water discharges to state waters including ground water. Coordinate with the EPA. |
| Public Water Supply and Sewer Permit | To allow construction of public water supply and sewer system and to protect public health. |
| Water Quality Waiver of Turbidity (318 Permit) (Montana Water Quality Act) | To allow for short-term increases in surface water turbidity during construction. Request may be forwarded from the FWP. |
| 401 Certification (Clean Water Act) | To ensure that any activity that requires a federal license or permit (such as the Section 404 permit from the Corps) complies with Montana water quality standards. |
| Hazardous Waste and Solid Waste Registration (various laws) | To ensure safe storage and transport of hazardous materials to and from the site and proper storage and transport and disposal of solid wastes. Some classes of solid waste disposal is covered under the MMRA. Solid wastes may be addressed under the operating permit. |

**Table 1. Permits, Licenses, and Approvals Required for the Montanore Project (cont'd).**

| Permit, License or Approval | Purpose |
|---|---|
| **Montana Department of Natural Resources and Conservation** | |
| Water Rights Permit (Montana Water Use Act) | To allow the diversion of surface water or use of ground water in excess of 35 gpm or more than 10 acre-feet of water annually. |
| Floodplain Development Permit (Montana Floodplain and Floodway Management Act) | To allow construction of project facilities within a 100-year floodplain. |
| 310 Permit (Montana Natural Streambed and Land Preservation Act) | To allow activities that physically alter or modify the bed or banks of a perennially flowing stream. |
| Streamside Management Zone Law | To control timber harvest activities within at least 50 feet of any stream, lake, or other body of water. |
| Burning Permit | To control slash or open burning outside the open burning season. |
| **Montana State Historic Preservation Office** | |
| Cultural Resource Clearance (Section 106 Review) | To review and comment on federal compliance with the National Historic Preservation Act. |
| **Montana Fish, Wildlife and Parks** | |
| 310 Permit (Natural Streambed and Land Preservation Act) | To allow construction activities by non-government entities within the mean high water line of a perennial stream or river. Coordinated with DNRC and the Lincoln County Conservation District. The FWP works with conservation districts to review permit and determine if a Water Quality Waiver of Turbidity (318 Permit) from the DEQ is needed. |
| Transmission Line Approval | To allow construction of the 230-kV transmission line across the Plum Creek conservation easement. |
| **Montana Department of Transportation** | |
| Approach Permit | To allow safe connection of roads to state highways. |
| Utility Occupancy and Location Agreement or Encroachment Permit | To allow utility within MDT rights-of-way. |
| **Montana Department of Commerce, Hard Rock Impact Board/Lincoln County** | |
| Fiscal Impact Plan (Hard Rock Mining Impact Act) | To mitigate fiscal impacts on local government services. |
| **Lincoln County Weed District** | |
| Noxious Weed Management Plan | To minimize propagation of noxious weeds. |

# Chapter 2. Alternatives, Including the Proposed Action

This chapter describes and compares the alternatives considered for the Montanore Project. It includes a detailed description and map of each alternative considered. This chapter presents the alternatives in comparative form, defines the differences between each alternative, and provides a clear basis for choice among options by the decision makers and the public. Because alternative development was in response to issues and concerns identified during scoping, public involvement and the significant issues identified for the project are discussed first. Following a discussion of the key issues, each alternative analyzed in detail is described. MMC's Proposed Action (Mine Alternative 2 and Transmission Line Alternative B) is described in detail. The other action alternatives incorporate many aspects of MMC's proposal and contain less detail. The last section of this chapter discusses the alternatives considered by the lead agencies in developing the alternatives, but that were eliminated from detailed analysis.

## 2.1 Public Involvement

### 2.1.1 Scoping Activities

A Notice of Intent (NOI) was published in the *Federal Register* on July 15, 2005. The NOI described KNF's and DEQ's intent to prepare an EIS for the proposed Montanore Project, set the dates for public scoping meetings, and solicited public comments. The NOI asked for public comment on the proposal until September 15, 2005. In addition, as part of the public involvement process, the lead agencies issued press releases, mailed scoping announcements, and held three public meetings. The public scoping meetings were held in Libby and Trout Creek, Montana and Bonners Ferry, Idaho in August 2005. Scoping activities are discussed in the *Scoping Report* (ERO Resources Corp. 2005). A public meeting on the proposed 230-kV transmission line was held in May 2005 to identify resources potentially affected by the proposed transmission line, suggested locations for the proposed line, alternatives to the proposed line, and mitigation measures for the proposed line. At the meeting, MMC presented information on the need for the proposed facility. Consultation and coordination is discussed in Chapter 4.

### 2.1.2 Issues

Based on the comments received during public scoping, the KNF and the DEQ prepared a Scoping Content Analysis Report that includes a summary of all comments received, organized by resource or issue (KNF and DEQ 2006). The KNF and the DEQ separated the issues into three groups: "key" issues that drove alternative development; "analysis" issues that were used in impact analysis; and non-significant issues. The KNF and the DEQ identified seven key issues; each issue is briefly discussed in the following sections. The indicators, baseline data, and analysis approach used to assess effects on these issues is described in *Issue Statements and Analysis Guidance* (ERO Resources Corp. 2006a), on file in the project record. Each resource section in Chapter 3 describes how the effects on each resource were evaluated.

#### 2.1.2.1 Key Issues

##### *2.1.2.1.1 Issue 1: Potential for acid rock drainage and near neutral pH metal leaching.*

Drainage from waste rock, tailings, and storm water runoff may adversely affect water resources in the project area. Effects will be assessed through predicted changes in water quality due to acid generation and near neutral pH metal leaching and release of elevated concentrations of trace elements as a result of weathering of mined materials, based on geochemical characterization data.

##### *2.1.2.1.2 Issue 2: Effects on quality and quantity of surface and ground water resources.*

**Ground Water Flow and Quality**

Underground mining activities may affect ground water in the mine area, which may indirectly affect Rock Lake and other waters in the CMW located above the mine. Discharges to ground water, such as from the proposed LAD Areas and the tailings impoundment, may affect ground water flows and quality. Mine-area effects will be assessed through a two-dimensional model, which will evaluate potential quantity impacts to mine area ground water and overlying and surrounding surface water during construction, operational, and post-mining periods. Effects on ground water at other facility locations will be assessed through estimating changes in flow path, quantity, and quality from discharges.

**Surface Water Flow**

Changes in ground water from underground mining operations, discharges, and altered topography may change surface water flow and lake levels. Effects will be predicted by evaluating changes in surface water flow in area springs, lakes, and streams. For lower-altitude spring and streamflows, changes will be estimated for mine operation diversions or discharges from or to streams.

**Surface Water Quality**

Discharges, such as to the LAD Areas or storm water runoff, containing metals, nutrients, and sediments may affect surface water quality in project area lakes, streams, and rivers. Effects will be predicted by estimating changes in selected water quality parameters.

##### *2.1.2.1.3 Issue 3: Effects on fish and other aquatic life and their habitats.*

Discharges containing metals, nutrients, and sediments and changes in surface water flows may affect fish and other aquatic life; the threatened bull trout and designated critical habitat in the analysis area are particularly of concern. Riparian habitat alteration from construction and operation of mine and transmission line facilities may affect future attainment of the KFP's Inland Native Fish Strategy (INFS) riparian management objectives (RMOs) for facilities located within riparian habitat conservation areas (RHCAs). The effects will be predicted by estimating changes in surface and ground water parameters, changes in habitat quality, changes in abundance and composition of aquatic life, long-term population trends, reproduction success, and growth rates of fish species.

##### *2.1.2.1.4 Issue 4: Changes in the project area's scenic quality.*

The proposed mine and transmission line may change existing scenic quality and visual character of the project area. Effects will be predicted by evaluating compliance with the KFP's visual quality objectives (VQOs). Effects will also be assessed quantitatively by determining mine

facilities and miles of transmission line visible from key observation points, important travel corridors, and the CMW.

#### *2.1.2.1.5 Issue 5: Effects on threatened or endangered wildlife species.*

**Grizzly Bear**

Construction and operation of mine and transmission line facilities may result in the loss of grizzly bear habitat or increase grizzly bear mortality and displacement. Effects will be predicted by estimating changes in percent of core habitat, linear open road density (ORD), percent open motorized route density (OMRD) greater than 1 mile per mile squared ($mi/mi^2$), percent total motorized route density (TMRD) greater than 2 $mi/mi^2$, percent habitat effectiveness, and displacement effects in affected Bear Management Units (BMU) in the Cabinet-Yaak Recovery Zone. Effects will also be assessed qualitatively by evaluating potential changes in effectiveness of grizzly bear movement corridors, human activity, and attractant availability.

**Lynx**

Construction and operation of mine and transmission line facilities may result in the loss or degradation of lynx habitat. Effects would be predicted by estimating percent of lynx habitat in a stand initiation structural stage, regeneration harvest in lynx habitat in the past 10 years, and reduction in snowshoe hare habitat in multi-story mature or late successional forest in affected Lynx Analysis Units (LAU). Effects also would be assessed qualitatively by evaluating connectivity between habitat blocks, habitat for alternative prey, quality of denning habitat, and traffic-related mortality risks in affected LAUs or adjacent LAUs.

#### *2.1.2.1.6 Issue 6: Effects on wildlife and their habitats.*

**Key Wildlife Habitats**

Construction and operation of mine and transmission line facilities may impact the quality or quantity of old growth, snags, and down wood habitat. Effects will be predicted by determining the following:

- Acres of vertical structure removed in designated and undesignated effective and replacement old growth
- Percent of designated old growth in the Planning Subunit (PSU)
- Acres of edge habitat
- Acres of interior old growth
- Estimated percent of potential cavity-nester population by PSU
- Coarse woody debris removed

**Forest Service Management Indicator Species – Pileated Woodpecker**

Construction and operation of mine and transmission line facilities may remove old growth and impact directly or indirectly cavity-nesting species, such as the pileated woodpecker. Effects will be predicted by determining changes in the estimated number of pileated woodpeckers potentially supported in the analysis area, based on acres of old growth habitat. Availability of down wood and snag habitat and indirect disturbance to pileated woodpeckers will also be evaluated.

#### *2.1.2.1.7 Issue 7: Effects on wetlands and non-wetland waters of the U.S.*

Construction and operation of mine and transmission line facilities may affect, directly or indirectly, wetlands and other waters of the U.S. The disturbance may alter wetland function and values. Effects will be predicted by estimating the number of acres filled, dewatered, or otherwise affected. Changes in wetland function and values will be evaluated qualitatively.

### 2.1.2.2 Analysis Issues

Issues identified by the public and the lead agencies during project scoping not considered as key issues, but important enough to be considered in the effects analysis are listed in Table 2. The lead agencies developed measures to address these issues, where needed to mitigate effects. The indicators, baseline data, and analysis approach used to assess effects on these issues is described in *Issue Statements and Analysis Guidance* (ERO Resources Corp. 2006a), on file in the project record.

**Table 2. Other Issues Evaluated in the EIS.**

| | | |
|---|---|---|
| Air Quality | Monitoring | Vegetation |
| American Indian Consultation | Recreation | Wilderness and Roadless Areas |
| Cultural Resources | Social/Economics | Migratory Birds |
| Electro-magnetic Fields and Radio/TV Interference | Soils | Forest Service Indicator Species – Elk and White-tailed Deer |
| Geology: Subsidence | Sound | Forest Service Indicator Species – Mountain Goat |
| Geotechnical | Threatened and Endangered Wildlife Species – Gray Wolf | Forest Sensitive Species |
| Land Use | Transportation | Other Species of Interest – Moose and Montana Sensitive Species |

### 2.1.2.3 Non-Significant Issues

Non-significant issues were identified by the lead agencies as those 1) outside the scope of the Proposed Action; 2) already decided by law, regulation, the KFP, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review…" (Sec. 1506.3).

One issue identified by the public during project scoping, an alternative combining Rock Creek and Montanore Projects, was beyond the scope of this environmental analysis. During scoping, commenters indicated the NEPA process should explore the possibility of an alternative that combines both the Rock Creek and Montanore Projects into one. The Rock Creek Project on the western side of the Cabinet Mountains underwent 14 years of analysis involving agency, tribal, and public participation. A final ROD was issued in 2001 selecting an action alternative. This alternative is discussed in section 2.13, *Alternatives Analysis and Rationale for Alternatives Considered but Eliminated*

## 2.2 Development of Alternatives

Alternatives were developed based on requirements for alternatives under regulations and rules implementing NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not analyzed in detail (40 CFR 1502.14). NEPA regulations do not specify the number of alternatives that need to be considered in the EIS, but indicate that a reasonable range of alternatives should be evaluated (40 CFR 1502.14). NEPA regulations require analysis of a No Action Alternative in an EIS. Likewise under MEPA, the DEQ is required to consider alternatives that are realistic, technologically available, and that represent a course of action that bears a logical relationship to the proposal being evaluated (ARM 17.4.603(2)(b)). Alternative alignments for the transmission line were developed based on requirements of MFSA (ARM 17.20.1607).

In addition to satisfying NEPA requirements for the selection of alternatives, projects subject to permitting by the Corps under the Clean Water Act also must comply with the 404(b)(1) Guidelines for discharge of dredged and fill material into wetlands and waters of the U.S. (40 CFR 230). It is anticipated that one or more Montanore Project facilities would need a 404 permit from the Corps. The 404(b)(1) Guidelines specify "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." An alternative is considered practicable "if it is available and it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes." Practicable alternatives under the Guidelines assume that "alternatives that do not involve special aquatic sites are available, unless clearly demonstrated otherwise." The Guidelines also assume that "all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise" (40 CFR 230.10(3)).

To develop a reasonable range of alternatives, the lead agencies separated the proposed Montanore Project into components. *Components* are discrete activities or facilities (*e.g.*, plant site or tailings impoundment) that, when combined with other components, form an alternative. Options were identified for each component. An *option* is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as thickened tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. Options with more favorable environmental characteristics were retained and other options were eliminated from further analysis. Section 2.13, *Alternatives Analysis and Rationale for Alternatives Considered but Eliminated*, describes the lead agencies' analysis of alternatives considered but eliminated from detailed analysis. Options comprising the Proposed Action were retained regardless of their environmental characteristics. Next, options for each component were combined into potentially viable alternatives. The transmission line was analyzed as a separate component from the mine facilities because any transmission line alternative could be combined with any mine alternative. Each component or alternative was developed to a level that allowed for comparison of significant environmental issues. If an action alternative were selected in the ROD, final design would be completed after the NEPA process is finished.

The KFP guides all natural resource management activities and establishes management standards for the KNF (USDA Forest Service 1987). The KFP establishes management direction in the form of prescriptions consisting of goals, objectives, standards, and guidelines. This direction may be established to apply throughout the forest plan area (forest-wide direction) or they may be established for only a part of the forest plan area, a management area (MA). The Montanore Project is being evaluated under the 1987 KFP. In developing alternatives to the Proposed Action, the lead agencies considered the management direction of the KFP. For example, the KFP, which incorporates INFS standards, establishes stream, wetland, and landslide-prone area protection zones called RHCAs and sets standards and guidelines for managing activities that potentially affect conditions within the RHCAs. An INFS standard for minerals management is to locate structures. support facilities, and roads outside of RHCAs. Where no alternative exists to siting facilities in RHCAs, the standard is to locate and construct facilities in ways that avoid impacts to RHCAs and streams, and adverse effects on inland native fish. Section 2.13.1.1.1, *Inland Native Fish Strategy* discusses that RHCAs were a key resource during the lead agencies' alternatives analysis. The lead agencies did not identify an alternative that would be in compliance with all KFP standards (see section 2.13.2.1, *Forest Plan Consistency*).

The MFSA requires that the proposed transmission line be approved if the findings listed in 75-20-301, MCA and related administrative rules can be made. Under this statute, the DEQ can approve a modified transmission facility or a transmission line alternative different from that proposed by MMC. Under 75-20-301(1)(c), MCA, the DEQ must find and determine that the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives.

Besides the No Action and Proposed Action alternatives for both the mine facilities and transmission line, the lead agencies analyzed in detail two mine alternatives and three transmission line alternatives. The following sections describe these alternatives. In the two mine alternatives and three transmission line alternatives to the Proposed Action, the issues addressed by the modification and mitigations that comprise the alternatives are discussed. The mine alternatives are discussed in the first sections, followed by the transmission line alternatives. The most significant modifications in the alternatives are relocating project facilities, such as the tailings impoundment. These alternative locations are summarized in Table 3. Other mitigations or changes to MMC's proposed mine alternative are listed in Table 4. (A similar table of mitigation proposed for the transmission line is found in Table 32.) Unless modified by the lead agencies, MMC's Mine Proposal as described in Alternative 2 would carry over into the two other mine alternatives. Similarly, aspects of MMC's proposed transmission line alternative, the North Miller Creek Alignment, as described in Alternative B, would carry over into the three other transmission line alternatives, unless modified by the lead agencies. The agencies could select segments from portions of transmission Alternatives B, C, D, or E.

**Table 3. Mine Alternative Comparison.**

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Operating Permit Areas | 3,628 acres | 2,606 acres | 3,245 acres |
| Disturbance Areas | 2,582 acres | 2,011 acres | 2,254 acres |
| ***Primary Facilities*** | | | |
| Mill site | Ramsey Plant Site in valley bottom in Upper Ramsey Creek | Libby Plant Site between Libby and Ramsey Creek drainages | Same as Alternative 3 |
| Adits and portals | Existing Libby Adit; two Ramsey Adits; Rock Lake Ventilation Adit | Existing Libby Adit; two additional Libby Adits; Rock Lake Ventilation Adit | Same as Alternative 3 |
| Above-ground conveyor | 1,200 feet long between Ramsey Adit portal and mill | 6,000 and 7,500 feet long (depending on the option) between Libby Adit Site and Libby Plant Site mill | Same as Alternative 3 |
| Tailings impoundment and seepage collection pond | 628 acres in Little Cherry Creek | 608 acres between Poorman and Little Cherry creeks | Same as Alternative 2 |
| Perennial stream diversion | Diversion of Little Cherry Creek 10,800 feet long around impoundment to Libby Creek | None | Same as Alternative 2 |
| Land application disposal areas | Two; one along Ramsey Creek and one between Ramsey and Poorman creeks | Two; similar to Alternative 2 with slight boundary modifications | Same as Alternative 3 |
| Water treatment | Land application, Libby Adit Water Treatment Plant, or additional water treatment plant at plant site, as necessary | Same as Alternative 2 | Same as Alternative 2 |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Primary access road | NFS road #278 (Bear Creek Road) plus new access road; 20 to 29 feet wide | NFS road #278 (Bear Creek Road) plus new access road; 26 feet wide; up to 56 feet wide to accommodate haul traffic and public traffic | Same as Alternative 3 |
| Concentrate loadout location | Kootenai Business Park in Libby | Same as Alternative 2 | Same as Alternative 2 |
| ***Facility Details*** | | | |
| New adits:length, grade, and portal elevation | Ramsey Adits: 16,000 feet long, 8% decline; Elevation: 4,400 feet<br>Rock Lake Ventilation Adit: Elevation: 5,560 feet | Upper Libby Adit: 13,700 feet long, 7% decline; Elevation: 4,100 feet<br>New Libby Adit: 17,000 to 18,500 feet long, depending on option; 5% decline; Elevation: 3,960 feet | Same as Alternative 3 |
| New access roads[†]<br>To Plant Site: | 1.7 miles connecting NFS roads #278 and #4781 | Existing NFS road #6212 and 4781 used for plant site access | Same as Alternative 2 |
| Realigned NFS road #278 at impoundment | 1.8 miles | 3.2 miles of new Bear Creek Road con-necting existing NFS roads #278 and #4781 | Same as Alternative 2 |
| To Adit Portal: | 0.3 mile to portal | None | Same as Alternative 3 |
| To LAD Area 1 | 1.0 mile | 0.7 mile | Same as Alternative 3 |
| To LAD Area 2 | 0.2 mile | 0.2 mile | Same as Alternative 3 |
| Pipelines<br>Tailings | Double-walled high-density polyethylene on surface adjacent to access road; 6.4 miles to impoundment | Double-walled buried adjacent to access road; 4.2 miles to impoundment | Same as Alternative 3; 6.4 miles to impoundment |
| Reclaim water | Double-walled high - density polyethylene on surface adjacent to access road | Double-walled high - density polyethylene buried adjacent to access road | Same as Alternative 3 |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Tailings pump stations | At Poorman Creek crossing | At each crossing of Ramsey and Poorman creeks | Same as Alternative 3 |
| Borrow areas | Four; 143 acres within impoundment footprint and 419 acres outside of impoundment footprint | Three; 124 acres within impoundment footprint and 92 acres outside of impoundment footprint | Five; 185 acres within impoundment footprint and 252 acres outside of impoundment footprint |
| Post-mining impoundment runoff | Riprapped channel to Bear Creek | Natural channel to Little Cherry Creek | Riprapped channel to Little Cherry Creek Diversion Channel |

†Temporary roads within the disturbance area of each facility not listed.

**Table 4. Comparison of Mitigation for Mine Alternatives.**

| Project Facility or Feature | Alternative 2<br>MMC's Proposed Mine | Alternative 3<br>Agency Mitigated<br>Poorman Impoundment Alternative | Alternative 4<br>Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| **Underground Bulkhead** | Not proposed | Maintain one or more underground bulkheasd if hydrologic modeling during initial mine operations (by year 5 of operations) determined that bulkheads would be necessary to minimize changes in East Fork Rock Creek and East Fork Bull River streamflows | Same as Alternative 3 |
| **Waste Rock Management**<br>Stockpile and Storage | Stored temporarily at unlined stockpile at LAD Area 1, Libby Adit Site, and/or Ramsey Adit portal, or hauled to the tailings impoundment area then used in impoundment dam. | Stored temporarily at stockpiles, lined if necessary, and then hauled to a lined, if necessary, location within impoundment footprint; then used in impoundment dam | Same as Alternative 3 |
| Characterization | Collect representative rock samples from the adits; ore zones; above, below and between the ore zones; and tailings for static and kinetic testing | Same as Alternative 2; in addition, collect samples of the lead barren zone, mineralized alteration haloes within the lower Revett, and the portions of the Burke and Wallace Formations for static and kinetic testing; assess potential for trace metal release from waste rock; conduct operational verification sampling within the Prichard Formation during development of the new adits | Same as Alternative 3 |
| Handling | Segregate potentially acid-generating materials and materials that could create near neutral pH metal leaching as they were mined and placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation | Same as Alternative 2; in addition, segregate potentially acid-generating materials and materials that could create near neutral pH metal leaching from portions of the lower Revett and Prichard Formations for additional kinetic and metal mobility testing and provide for selective handling as indicated by test results | Same as Alternative 3 |
| **Geotechnical Testing to Reduce Subsidence Risk** | Underground geotechnical investigations would be conducted as the Libby Adit was completed; ongoing subsidence monitoring | Libby Adit evaluation program part of Alternative 3. Testing same as Alternative 2 with the following additions:<br>Install several surface elevation monitoring points over the ore body, working with the lead agencies on the location of these survey sites | Same as Alternative 3. |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| | Not specified | Back-analyze the pillar failure at the Troy Mine using publicly available data to compare the Troy Mine design in effect at the time of the failure with the Montanore design; undertake numerical modeling to further evaluate expected design performance, to assess potential for shear failure at the pillar/roof or pillar/floor interface, and pillar columnization and sill stability between the two ore zones | Same as Alternative 3 |
| | Not specified | Conduct lineament analysis, mapping and statistical analysis of joint frequency and attitude, strain-relief overcoring, and further exploratory drilling | Same as Alternative 3 |
| | Not specified | Complete roof support analyses | Same as Alternative 3 |
| **Recreation/Scenery** | Not specified | Design and construct a scenic overlook with interpretive signs south of the switchback on NFS road #231 (Libby Creek Road) above Howard Creek with views of the Libby Adit Site | Same as Alternative 3 |
| | Not specified | Fund a volunteer campground host from Memorial Day through Labor Day at Howard Lake campground | Same as Alternative 3 |
| | Not specified | Inspect and maintain access changes used in wildlife mitigation | Same as Alternative 3 |
| **Scenery** | Not specified | Shield or baffle night lighting at the Libby Adit Site and Libby Plant Site | Same as Alternative 3 |
| | Not specified | Develop final regrading plans for each facility to reduce visual impacts of reclaimed mine facilities | Same as Alternative 3 |
| | Not specified | At the end of operations, place any waste rock not used in construction either back underground or use it in regrading the tailings impoundment | Same as Alternative 3 |
| **Waste Management Solid Wastes** | Bury certain wastes identified at closure underground in mined-out areas | Disposal of materials underground minimized and identified at closure | Same as Alternative 3 |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| **Sanitary Wastes** | Closed sanitary system with waste stored in buried sewage tanks; tanks pumped and disposed off-site | Sanitary wastes treated and disinfected on-site and then reused in the mill or discharged at LAD Areas | Same as Alternative 3 |
| **Sound** | Not specified | Operate all surface and mill equipment so that sound levels do not exceed 55 dBA, measured 250 feet from the mill for continuous periods exceeding an hour | Same as Alternative 3 |
| | Not specified | Adjust intake and exhaust ventilation fans in the Libby Adits so that they generate sounds less than 82 dBA measured 50 feet downwind of the portal | Same as Alternative 3 |
| | Not specified | Use specially designed low-noise fan blades or active noise suppression equipment, if necessary | Same as Alternative 3 |
| **Transportation** Bear Creek Road Reconstructed Width | 20 to 29 feet | 26 feet | 26 feet; up to 56 feet wide to accommodate haul traffic and public traffic |
| Other roads | Single lane | Same as Alternative 2, except up to 56 feet wide to accommodate mixed haul traffic and public traffic | Same as Alternative 3 |
| Bear Creek Road south of impoundment | Left in current condition | 3.2 miles of new road constructed south of the impoundment for public access; selected segments gravelled | Surface the Bear Creek Road from the new Libby Plant Access Road to the Libby Creek Road with 6 inches of gravel 16 feet wide |
| Culverts | Install and/or extend culverts | Replace as necessary to comply with INFS standards, such as fish passage or conveyance of adequate flows | Same as Alternative 3 |
| Bear Creek Bridge | Not replaced | Replace and widened to a width compatible with a 26-foot wide Bear Creek Road | Same as Alternative 3 |
| Gated roads | Not specified | Install and maintain each closure; gates would have dual-locking devices to allow the KNF fire or administrative access | Same as Alternative 3 |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| **Soil Salvage and Handling** | Double-lift salvage at Little Cherry Creek Tailings Impoundment, Seepage Collection Pond, Borrow Areas, other potential disturbances within impoumdment area. Single-lift salvage at Little Cherry Creek Diversion Channel, Ramsey Plant Site, Upper Libby Adit Site, LAD Areas, and road disturbances | Double-lift salvage at all disturbances where soil is to be salvaged except road disturbances. These disturbances include Poorman Tailings Impoundment, Seepage Collection Pond, Borrow Areas, other disturbances within impoundment area, Libby Plant Site, Upper Libby Adit Site, and LAD Areas | Similar to Alternative 3, except double-lift salvage at Little Cherry Creek Tailings Impoundment and Little Cherry Creek Diversion Channel |
| | Not specified | Map soils not mapped at an intensive level at an intensive level prior to salvage to assure maximum amount of suitable soil was salvaged | Same as Alternative 3 |
| | Not specified | Salvage soils at low moisture content to minimize compaction | Same as Alternative 3 |
| **Vegetation Removal and Disposition** | As proposed in Plan of Operations | Prepare a Vegetation Removal and Disposition Plan for lead agencies' approval | Same as Alternative 3 |
| | Not specified | Where possible, salvage, chip, and use limited amounts of slash as mulch; use large woody debris in fisheries mitigation | Same as Alternative 3 |
| **Soil Stockpiles** | Stabilize soil stockpiles when they reach their design capacity and seed during the first appropriate season following stockpiling | Incrementally stabilize soil stockpiles (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity | Same as Alternative 3 |
| | First-lift soils stockpiled together at tailings impoundment | Segregate first-lift soils based on rock content and stockpiled separately at tailings impoundment | Same as Alternative 3 |
| | Second-lift soils stockpiled together at tailings impoundment | Second-lift clay-rich glaciolacustrine soils stockpiled separately from other second-lift subsoils at tailings impoundment | Same as Alternative 3 |
| | For road disturbances, salvaged soils stockpiled along entire road corridors | For road disturbances, salvaged soils stockpiled in clearings or in areas of recent timber harvest immediately adjacent to new roads | Same as Alternative 3 |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| **Soil Replacement** | Embankment of Little Cherry Creek Tailings Impoundment would be covered with 24 inches of replaced soil using two lifts; rest of impoundment would be covered with 18 inches of replaced soil using two lifts | Entire tailings impoundment would be covered with 24 inches of replaced soil using two lifts | Same as Alternative 3 |
| | Rocky and non-rocky topsoil would be used as upper 9 inches of respread soil on embankment of tailings impoundment | Rocky topsoil would be used as upper 9 inches of respread soil on embankment of tailiings impoundment to minimize erosion | Same as Alternative 3 |
| | Soil would be replaced using single lift at Ramsey Plant Site, Little Cherry Creek Diversion Channel, Libby Adit Site, road disturbances, and other potential disturbances | Soil would be replaced using two lifts at all disturbances requiring soil replacement except road disturbances | Same as Alternative 3, except soil would be replaced in the Little Cherry Creek Diversion Channel |
| **Revegetation** Seedbed preparation | Prior to soil replacement, embankment of tailings impoundment would be ripped; top of impoundment would not be ripped | Prior to soil replacement, entire tailings impoundment would be ripped to minimize compaction, break up surface crust and enhance rooting depth | Same as Alternative 3 |
| | Apply organic amendments as needed or when soil tests demonstrate deficiencies | Agency-approved wood-based organic amendment would be incorporated into upper 4 inches of respread soil to improve nutrient content and the organic matter level to 1 percent by volume | Same as Alternative 3 |
| | Use mycorrhizae-inoculated trees and shrubs if readily available | Mycorrhizae would be added to soil in areas where trees are to be planted | Same as Alternative 3 |
| Seed Mixtures | Interim and permanent seed mixtures | Permanent seed mixture only | Same as Alternative 3 |
| | Native and introduced species | Native species only, to the extent they were commercially available | Same as Alternative 3 |
| Tree and Shrub Density After 15 Years | 283 trees/acre (assumes a 65 percent survival rate of 435 trees/acre planted)<br>Unspecified (200 shrubs/acre planted) | 400 trees/acre<br>200 shrubs/acre | Same as Alternative 3 |

| Project Facility or Feature | Alternative 2<br>MMC's Proposed Mine | Alternative 3<br>Agency Mitigated<br>Poorman Impoundment Alternative | Alternative 4<br>Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Noxious Weeds | No more than 10 percent noxious weeds | Less than 10 percent cover of Category 1 weeds and 0 percent of Category 2 and 3 weeds; would not dominate an area greater than 400 sq ft | Same as Alternative 3 |
| Total Cover | 60 percent live vegetation cover or 80 percent of control site total cover | 80 percent of control site total cover | Same as Alternative 3 |
| Monitoring Plan | 3 consecutive years of success | 20 years | Same as Alternative 3 |
| **Monitoring** | | | |
| Ground Water Dependent Ecosystem | Not proposed | Complete a comprehensive ground water-dependent ecosystem inventory an area overlying the proposed underground mine, focusing on areas below about 5,600 feet in the mine area | Same as Alternative 3 |
| | Not proposed | Measure flow of any spring overlying the proposed mine twice, once in early June when the area was initially accessible, and once between mid-August and mid-September | Same as Alternative 3 |
| | Not proposed | Complete a vegetation survey at each identified spring or seep, identify trigger species to monitor effects, develop mitigation for mine-induced adverse effects | Same as Alternative 3 |
| Surface and Ground Water and Aquatic Biology Monitoring | Detailed monitoring around proposed project facilities | Similar to Alternative 2 around project facilities. Additional monitoring in East Fork Rock Creek, East Fork Bull River, Rock Lake, and Libby Lakes<br>Analyze additional parameters, such as chlorophyll *a* and acrylamide<br>Install an array of small-diameter boreholes from, and continuous recording pressure transducers within the mine and adits as construction progressed | Same as Alternative 3 |
| Aquatic Habitat in Little Cherry Creek Diversion Channel | Not specified | None needed | Habitat surveys in diverted Little Cherry Creek every 2 years |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Long-term Maintenance of Little Cherry Creek Diversion Channel | Not specified | None needed | Fund a long-term maintenance account |
| **Mitigation Plans** | | | |
| Fisheries Fish loss in diverted creeks | Collect all fish in Little Cherry Creek and move the fish to the newly constructed diversion channel | None needed | Same as Alternative 2 |
| | Implement mitigation projects to mitigate fisheries loss | Complete habitat inventory in East Fork Bull River; develop instream structures in East Fork Bull River, Libby Creek, Ramsey Creek, and Poorman Creek | Same as Alternative 3 |
| Sediment | Optional inventory and implementation of sediment abatement projects | Identify existing sediment sources in Libby Creek drainage and implement sediment abatement and instream stabilization | Same as Alternative 3 |
| Wildlife (see Table 32 for additional mitigation for transmission line) | | | |
| Old Growth | Not specified | Designate 404 acres of effective or replacement old growth on National Forest System lands | Designate 356 acres of effective or replacement old growth on National Forest System lands |
| Snags (Cavity Habitat) | Not specified | Leave snags in disturbance areas, such as LAD Areas, unless required to be removed for safety reasons | Same as Alternative 3 |
| Big Game Security | Not specified | KNF to place barriers on five roads year-long: NFS road #4776B Horse Mountain (2.8 miles); NFS road #6205D Big Hoodoo (4.0 miles); NFS road #6209E Crazyman Creek (1.1 mile); NFS road #6787B Hoodoo Bear (1.6 mile); and NFS road #14442 Lampton Pond (0.6 mile) | Same as Alternative 3 |
| Mountain Goat | Not specified | Fund aerial surveys three times annually | Same as Alternative 3 |
| | Not specified | No blasting at adit portals from June 1 to June 30 | Same as Alternative 3 |

| Project Facility or Feature | Alternative 2<br>MMC's Proposed Mine | Alternative 3<br>Agency Mitigated<br>Poorman Impoundment Alternative | Alternative 4<br>Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Forest Sensitive Birds and State Bird Species of Concern | Not specified | Complete surveys to locate active nests in appropriate habitat and avoid during nesting, or not remove vegetation in the nesting season | Same as Alternative 3 |
| Migratory Birds | Not specified | Fund or conduct monitoring of landbird populations annually on two, standard Region One monitoring transects within the Crazy and Silverfish PSUs | Same as Alternative 3 |
| Grizzly Bear<br>Road and Trail Access Changes Prior to Libby Adit evaluation program | None proposed | Seasonally change access of (install gates) 6 roads totalling 14.5 miles. Decommission or place into intermittent stored service 13 roads totalling 20.3 miles | Same as Alternative 3 |
| Prior to Montanore Project construction | NFS road #4784 (upper Bear Creek Road) year-long for the life of the project<br>NFS road #4724 (South Fork Miller Creek) on a seasonal basis (April 1 to June 30) for the life of the project | Decommision or place into intermittent stored service 6 roads totalling between 9.6 and 11 miles.<br>Convert trail #935 in upper Rock Creek to non-motorized access | Same as Alternative 3 |
| Land Acquisition for Physical Disturbance | Purchase 2,826 acres of private lands in the Cabinet-Yaak Ecosystem | Secure or protect replacement grizzly bear habitat (through conservation easement, including motorized route access changes or acquisition) of between 3,995 and 4,002 acres (depending on the transmission line alternative) of private lands in the Cabinet-Yaak Ecosystem and a 5-acre parcel near Rock Lake Meadows below Rock Lake | Same as Alternative 3 except protected habitat would be between 4,467 and 4,474 acres (depending on the transmission line alternative) of private lands in the Cabinet-Yaak Ecosystem and the 5-acre Rock Lake parcel |
| Habitat Enhancement for Reduced Habitat Effectiveness | Not specified | Enhance grizzly bear habitat on between 7,449 and 8,014 acres (depending on the transmission line alternative) of private lands in the Cabinet-Yaak Ecosystem | Enhance grizzly bear habitat on between 7,758 and 8,323 acres (depending on the transmission line alternative) of private lands in the Cabinet-Yaak Ecosystem |

| Project Facility or Feature | Alternative 2 MMC's Proposed Mine | Alternative 3 Agency Mitigated Poorman Impoundment Alternative | Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| Personnel Funding | Fund two new full-time wildlife positions, a law enforcement officer, and an information and education specialist | Fund three new full-time wildlife positions, a law enforcement officer before evaluation phase, an information and education specialist, and a bear specialist during construction and operation phases | Same as Alternative 3 |
| Other Measures | Not specified | Fund 100 bear-resistant garbage containers plus an additional 20 per year, after the first year of construction phase, for distribution to the community<br>Fund fencing and electrification of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem<br>Fund an initial 10 electric fencing kits for use at bear problem sites that can be installed by FWP bear specialists, and then 2 replacements per year | Same as Alternative 3 |
| Wetlands Mitigation Ratios—Jurisdictional Wetlands | Forested and herbaceous wetlands on a 2:1 ratio; shrub wetland on a 1:1 ratio | Ratios based on type of mitigation: created wetlands credited on a 2:1 ratio, restored wetlands credited on a 1.5:1 ratio | Same as Alternative 3 |
| Mitigation of Non-jurisdictional Wetlands | Not proposed | On a 1:1 ratio | Same as Alternative 3 |
| Wetland Soil Management | Not specified | Wetland soils and sod salvaged and used at mitigation sites | Same as Alternative 3 |
| Pre-construction Hydrologic Monitoring of Mitigation Sites | Not specified | Six months (April–September) of monthly monitoring prior to development of sites | Same as Alternative 3 |

## 2.3 Alternative 1—No Action, No Mine

In this alternative, MMC would not develop the Montanore Project, although it is approved under DEQ Operating Permit #00150. The Montanore Project, as proposed, cannot be implemented without a corresponding Forest Service approval of a Plan of Operations. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the mine or a transmission line. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. The conditions under which the Forest Service could select the No Action Alternative or the DEQ deny MMC's applications for MPDES and air quality permits, transmission line certificate, and MMC's operating permit modifications are described in section 1.6, *Agency Roles, Responsibilities, and Decisions*.

## 2.4 Alternative 2—MMC's Proposed Mine

### 2.4.1 Construction Phase

#### 2.4.1.1 Permit and Disturbance Areas

Development of the Montanore Project would require construction of an underground mine and adits (underground access), and surface facilities, such as a mill, tailings impoundment, and access roads (Figure 2). In MMC's proposal, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 mile from the CMW boundary. An additional adit on private land owned by MMC in the Libby Creek drainage and a ventilation adit on private land owned by MMC east of Rock Lake would be used for exploration and ventilation. A tailings impoundment is proposed to be constructed in the Little Cherry Creek drainage, and would require the permanent diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek are proposed to allow for discharge of water to the surface. A portion of the waste rock may be stored temporarily at LAD Area 1 and at the Libby Adit Site. Permit area boundaries would be established around each of these facilities (Figure 3). The total operating permit area would total 3,628 acres and the total permitted disturbance area would be 2,582 acres (Figure 3, Table 5). MMC would upgrade NFS roads #278 (Bear Creek Road) and #4781 (Ramsey Creek Road); short segments of these roads would be realigned. For analysis purposes, the lead agencies used a disturbance area to assess affects on surface resources. For maximum flexibility, MMC would bond to cover the full disturbance area even if no proposed activities were planned. This would allow MMC to construct temporary and seasonal roads and other facilities within these disturbance area boundaries as needed.

The underground mine would produce up to 20,000 tons of ore daily, or 7 million tons per year at full production. Currently delineated mineral resources, estimated at about 135 million tons, extend from Rock Lake to St. Paul Lake beneath the CMW (Figure 4). These estimates are based on a limited number of drill holes. The deposit has not been fully delineated and likely extends farther north than the available drilling information. Considering an expected ore extraction of 65 to 75 percent, waste rock dilution, and initial production rates, the mine is anticipated to have a production life of about 16 years. Three additional years may be needed to mine 120 million tons.

**Table 5. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 2.**

| Facility | Disturbance Area (acres) | Permit Area (acres) |
|---|---|---|
| Existing Libby Adit Site | 22 | 219 |
| Rock Lake Ventilation Adit | 1 | 1 |
| Ramsey Plant Site and Adits | 52 | 185 |
| Little Cherry Creek Tailings Impoundment | 1,928 | 2,458 |
| Little Cherry Creek Tailings Impoundment and Seepage Collection Pond | 628 | |
| Borrow areas outside impoundment footprint | 419 | |
| Soil stockpiles | 53 | |
| Other potential disturbance (Diversion Channel, roads, storage areas) | 828 | |
| LAD Area 1 and Waste Rock Stockpile | 247 | 261 |
| LAD Area 2 | 183 | 226 |
| Access Roads[†] | | |
| Bear Creek Road (NFS road #278 from U.S. 2 to Tailings Impoundment)[§] | 79 | 10 |
| Tailings Impoundment permit area to Ramsey Plant Site (NFS road #278 to new haul road to NFS road #4781) | 48 | 172 |
| Libby Adit Site (NFS road #2316 and #6210) to Ramsey Creek Road (NFS road #4781) | 22 | 96 |
| Total | 2,582 | 3,628 |

[†]Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.
[§]A small area of the Bear Creek Road would be within a permit area outside of the Little Cherry Creek Tailings Impoundment permit area (Figure 3).

MMC's proposed construction, operation, mitigation, and reclamation plans for the mine are described in the following sections.

A 230-kV transmission line to supply electrical power would be built from the Sedlak Park Substation to the Ramsey Plant Site. Facilities associated with MMC's proposed transmission line are discussed in section 2.8, *Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative).*

During the construction phase, MMC would construct the Ramsey Plant Site (Figure 5), two Ramsey Adits, and a Ventilation Adit near Rock Lake (Figure 4), tailings impoundment dams, transmission line, and other ancillary infrastructure necessary to initiate mining activities. Construction of a ventilation adit near Rock Lake (Figure 4) may be deferred until initial mine production commended, depending on ventilation requirements. MMC also would undertake underground delineation drilling in the ore body. MMC also would develop the Libby Loadout Facility at the Kootenai Business Park in Libby for concentration storage and shipping. The Libby Loadout Facility is discussed in section 2.4.2.2.2, *Concentrate Shipment.*

U.S. 2 south of Libby to the Bear Creek Road and the Bear Creek Road (NFS road #278) would be the primary access to the mine site. During the construction phase, the Bear Creek Road would be widened and surfaced with chip-seal. MMC would use the Libby Creek Road (NFS road #231) during reconstruction of the Bear Creek Road. MMC's road use for the project is discussed in section 2.4.2.7, *Transportation and Access*.

#### 2.4.1.2 Vegetation Clearing and Soils Salvage and Handling

Prior to any construction, vegetation would be cleared and suitable soils salvaged. Merchantable timber would be measured, purchased from the KNF, and then cleared before soil removal. Non-merchantable trees, shrubs, and slash would be removed using a brush blade to minimize soil accumulation, piled into windrows, and burned. All requirements of the Montana Slash Disposal Law would be observed.

MMC would salvage and replace soils on most disturbed areas, except where slopes were too steep or where the water table was high. Proposed salvaged depths would vary between 9 and 65 inches, based on physical and chemical data collected during the baseline soils survey. Certain soils on a portion of the tailings impoundment would be salvaged in two lifts. The surface layer would be salvaged in other disturbances.

Soil stockpiles would be located in areas to minimize impacts from wind and water erosion, impacts from ongoing operations, and away from sensitive areas (*i.e.*, wetlands and streams) (Figure 6, Figure 7, and Figure 8). If necessary, stockpile locations would be modified to meet field conditions and accommodate quantities of soils actually salvaged. Soils with more than 50 percent rock fragments generally would not be salvaged. Soils with rock fragment contents up to 60 percent by volume would be salvaged in some areas to provide erosion protection on the tailings impoundment dam and portal patio slopes. Reclamation soil thicknesses would be adjusted, if necessary, according to results of interim reclamation and site-specific conditions, as determined by the lead agencies.

Soil would be salvaged and replaced without stockpiling when feasible, primarily at the tailings impoundment, or stockpiled as close as possible to redistribution sites. Active soil stockpiles would be protected to minimize wind and water erosion. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps where possible. As stockpiles reached their design capacity, they would be stabilized and seeded during the first appropriate season following stockpiling. Fertilizer, mulch, and tackifier would be applied as necessary to promote soil stabilization and successful revegetation. Weed control would be an important aspect of the soil storage and protection. MMC's Weed Control Plan describes the measures that would be employed to minimize noxious weeds.

#### 2.4.1.3 Ramsey Plant Site and Adits

MMC would build a plant adjacent to Ramsey Creek (Figure 5), consisting of the following facilities:

- Mill and administration building and associated parking
- Tailings thickener tank
- Mine/yard pond
- Coarse ore stockpile building

- Warehouse
- Explosives storage
- Electrical substation
- Other miscellaneous facilities

Two parallel, 16,000-foot-long production adits would be excavated directly southwest of the Ramsey Plant Site (Figure 4). One adit would serve as the main conveyor adit for ore extraction and an exhaust airway. The other adit would provide an intake for fresh air underground and access for personnel and materials during operations. The adit portals would be outside the CMW boundary. Portal patios, which are flat working surfaces outside the adits, would be constructed by cutting into the sideslope, creating a vertical face for adit construction and an area for staging of supplies. Each adit would be about 30 feet wide by 30 feet high. During adit construction, a lined retention pond would be constructed at the Ramsey Plant Site to handle water during construction of the Ramsey Adits. Water would report to this pond from the adits. A pipeline would be installed to convey water to LAD Areas. The pond would provide storage of 62 acre-feet of water (1 week's storage for a temporary adit discharge of 2,000 gallons per minute (gpm)). After the Starter Dam was built at the impoundment site (see section 2.4.1.5, *Tailings Impoundment*), water would be diverted to the impoundment area for storage and mill startup. The pond would then be enlarged and relined, once storage at the tailings impoundment were available, to the final size required for operations (shown as the mine/yard pond on Figure 5). The pond would be available for use during construction and would provide additional storage capacity/surge storage during mill start-up and other periods.

Underground development would include excavation of a crusher station and related ore and waste rock bins, and development of main mining benches, haulage drifts, and ore and waste passes. At the terminal end of the Ramsey Adits, MMC would build an underground primary rock crusher. MMC anticipates construction of the Ramsey Adits that would connect with the Libby Adit to the crusher station would begin about 6 months after project inception and take about 12 months. The Ramsey Adits would decline to the ore body at an 8 percent slope. MMC would construct the Ramsey Adits from both the surface at the Ramsey Creek portal and underground from the Libby Adit Site.

MMC would excavate a ventilation raise, the Rock Lake Ventilation Adit, beginning vertically from the center of the ore body and then horizontally to private land 800 feet east and 600 feet higher than Rock Lake (Figure 4). Air would be drawn into the ventilation raise to supply fresh air for underground workers. No fans or other facilities are proposed on the surface. The Rock Lake Ventilation Adit would be a combination of a drift from the ore body, a vertical raise, and a short adit to the surface. The portal opening would be about 15 feet wide by 15 feet high and gated with a steel grate or similar structure. The short adit from the vertical raise to the portal would be sloped back into the mine, collecting any water inflow back into the mine. Grouting and other water management techniques would be used to minimize inflow of subsurface water into the raise. The ventilation raise would be constructed from inside the mine and would not require any surface activities, with the exception of creating the surface opening. Total surface disturbance associated with the Rock Lake Ventilation Adit would be about 1 acre. The ventilation adit is not anticipated to be required to support mine construction activities but would be installed during the initial mine production period.

In 2006, MMC received DEQ approval for Minor Revision (MR 06-002) to extend the Libby Adit 3,300 feet to the ore body and to conduct underground evaluation drilling and geotechnical and hydrogeologic studies. The KNF has not approved any activities described in Minor Revision 06-002 that may affect National Forest System lands. MMC would use the Libby Adit Site for ventilation and a secondary escape route for underground workers (Figure 6). If the KNF did not approve the evaluation drilling, it would begin at the start of the project. Additional drilling beyond the evaluation drilling would be completed during the pre-production phase of the project to provide information required for mine planning beyond the first 5 years of production.

#### 2.4.1.4 Waste Rock Management

All waste rock produced during construction and operations would be stored in waste rock stockpiles in the Ramsey Plant Site or LAD Area 1, and then used for tailings embankment construction, Ramsey Plant Site and portal construction, or placed in mined out sections of the mine (Table 6) for ongoing tailings dam construction. During pre-production and possibly during operations, waste rock would be temporarily stored at an unlined area in the LAD Area 1 for future use in dam construction material. Waste rock stored in the LAD Area 1 waste rock stockpile would be no higher than 50 feet above the original ground contours. All waste rock would be removed from the stockpiles by the end of operations. For scheduling and construction reasons, some waste rock generated during adit construction would be stored temporarily near the adits (Libby Adit Site or Ramsey Plant Site). The majority of the waste rock would be directly hauled to LAD Area 1 (Figure 7) or to the tailings impoundment area for dam construction. During operations, waste rock generated that would not be required for the tailings impoundment would be placed in mined out areas underground.

The waste rock sampling plan is described in MMC's waste rock management plan (Geomatrix 2007b). During mining, MMC would collect representative rock samples from the adits; ore zones; above, below, and between the ore zones; and tailings. MMC would conduct static and kinetic testing on these samples to evaluate the acid-producing potential. Acid-base accounting results, total sulfur analyses, and pH measurements would be documented.

Acid-generating materials would be segregated for special handling as they were mined and would be placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation. Such locations could include the inner portions of the tailings dam and inside the mine workings. No rock materials would be used for construction before determination of its acid-producing potential. In addition, waste rock generated from the underground barren zone would be minimized, to the extent possible, due to higher lead concentrations present in this rock zone, and the greater potential for acid generation. Barren zone waste rock would be segregated from other waste rock and disposed underground.

All waste rock data would be evaluated with water monitoring data to determine whether any changes in water quality were the result of acid or sulfate production. Annual reports documenting sample location, methodology, detection limits, and testing results would be submitted to the lead agencies. Acid-base accounting results would be correlated with lithology and total sulfur analyses.

**Table 6. Estimated Schedule for Waste Rock Production and Disposal.**

| Project Stage | Tons | Bank Cubic Yards | Disposal Area |
|---|---|---|---|
| Evaluation Drilling | 298,000 | 130,000 | Temporary lined storage pile at Libby Adit Site, then to tailings embankment |
| Pre-production Waste Rock | 1,548,000 | 668,000 | Temporary unlined storage pile at both adit sites, then to tailings embankment |
| Ore | 333,000 | 148,000 | Temporary unlined storage pile near the Ramsey Adit portal, then to mill |
| Initial Production | 288,000 | 128,000 | Tailings embankment |
| Production with Tailings | 576,000 | 256,000 | Tailings embankment |
| | 144,000 | 64,000 | Inside mine |
| Production Only | 864,000 | 384,000 | Inside mine |
| Total Waste Rock | 3,718,000 | 1,630,000 | |

### 2.4.1.5 Tailings Impoundment

The proposed tailings impoundment site is 5 miles northeast of the Ramsey Plant Site, in the Little Cherry Creek watershed. The tailings impoundment would consist of several structures: a diversion dam, a starter dam, a main dam, two saddle dams, and a seepage collection system (Figure 8). The tailings impoundment has a design capacity of about 115 to 120 million tons and, at the planned operating period of 16 years, the tailings impoundment would have an excess capacity of an additional 22 million tons, or 3 years of production (Table 7).

**Table 7. Daily and Total Tailings Production Estimates.**

| Time Frame | Daily Production (tons per day) | Total Production (tons) |
|---|---|---|
| Years 1-5 | 12,500 | 23 million |
| Years 6-10 | 17,000 | 31 million |
| Years 11-16 | 20,000 | 44 million |
| Years 17-19 | 20,000 | 22 million (excess capacity) |
| Maximum Capacity | | 120 million |

#### *2.4.1.5.1 Diversion Dam and Channel*

The initial step in constructing the tailings disposal facility would be the construction of a Diversion Dam and Channel. A permanent diversion dam and channel system would be constructed at the tailings impoundment area to route Little Cherry Creek around the tailings impoundment to an unnamed tributary of Libby Creek (Figure 8).

The Diversion Channel would consist of three main components: an "engineered" upper channel, a middle channel, and a lower channel. Overall length of the Diversion Channel would be 10,800

feet. The upper channel would convey the Probable Maximum Flood (4,250 cubic feet per second (cfs)) around the tailings impoundment. The upper channel would be 3,200 feet long, 40 to 60 feet deep, and 19 feet wide at the bottom. Within the upper channel, a secondary channel would be constructed. The secondary channel would be designed to contain the average annual high flow in the channel. Wetlands along the upper channel would be excavated. Excavated channel material would be used to construct the Diversion Dam and the Starter Dam; any remaining material from the excavation would be used to construct a portion of the South Saddle Dam. Excavated wetland soils may be used in wetland mitigation.

If the bedrock were deeper than anticipated or of poor quality, riprap would be used for erosion protection. The channel foundation would be lined with compacted silty clay/clay to keep surface flows above the riprap. The upper channel would include a 300-foot, stair-stepped chute structure at the channel outlet. This structure, which would be comprised of 3-foot-high gabions, would dissipate flow energy, minimize erosion potential, and increase channel stability. If erosion were observed during or at the end of operations, rockfill bars or gabions would be placed perpendicular to the natural stream channel below the Diversion Channel to provide energy dissipation and protect against erosion.

MMC identified two channels that could be used to convey water from the upper channel to Libby Creek: Channel A and Channel B (Figure 8). Channel A currently is a 6,200-foot long intermittent channel that flows primarily in response to snowmelt and significant rain events, with some reaches of perennial flow. A larger culvert at NFS road #1408 west of Libby Creek would be installed. Channel B is south of the lower reach of Channel A and is 3,000 feet long. Flow in Channel A normally does not go into Channel B, except possibly during high flow events. A control gate structure would be installed where Channel A and B join to control flow in both channels. A energy dissipater would be constructed at the outlet section of both channels to reduce flow velocity of water entering Libby Creek. MMC identified a variety of measures that may be used to control erosion and sedimentation and to create aquatic habitat (Geomatrix 2006b).

After the upper engineered section of the Diversion Channel was constructed, and improvements to Channels A and B were completed, MMC would construct a Diversion Dam across Little Cherry Creek. The Diversion Dam would initially act as a low water storage dam, which would direct Little Cherry Creek into the Diversion Channel. Initially, the Diversion Dam would be 60 feet high and have a crest elevation of 3,695 feet. The initial dam would have a low permeability center, with general fill in the upstream and downstream outer zones, and riprap on the diversion side to minimize erosion. The slopes would be steep (0.5H:1V) (Figure 9). Immediately before closure of the Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. The old Little Cherry Creek channel below the tailings impoundment would no longer receive surface flows from above the Diversion Dam.

Toward the end of mine operations, when the tailings impoundment elevations would rise above the dam, it would be raised to a height of 83 feet (3,718 feet elevation) in conjunction with the tailings. Raising of the initial dam would be completed using a homogeneous low permeability fill material, with tailings providing support for the tailings impoundment side of the fill.

#### *2.4.1.5.2 Borrow Areas*

To supplement materials excavated during Diversion Channel construction, material would be excavated from borrow areas for use in the Starter Dam, North Saddle Dam, Diversion Dam, Diversion Channel, and other facilities. Material requirements and quality would vary by facility. Borrow material also would be required for rip rap, road material, reclamation capping, and other uses. MMC has identified four borrow areas, one within the impoundment area (Borrow Area A) and three west and south of the impoundment area (Borrow Areas B, C, and D), as sources of construction material (Figure 8).

#### *2.4.1.5.3 Starter Dam*

After the Diversion Dam and Channel were operational and Little Cherry Creek was diverted, a Starter Dam would be required to establish the initial impoundment area. The Starter Dam would be a 120-foot-high earthfill dam across former Little Cherry Creek, with a 30-foot-wide crest, and slopes of 2.5H:1V above 3,450 feet elevation and 4H:1V below 3,450 feet elevation on both the upstream and downstream sides of the dam (Figure 9). The fill would consist of locally available silt-sand-gravel glacial deposits from borrow areas. Waste rockfill from the underground mine development may also be used in the downstream portion of the dam, depending on the final rock production and construction schedule. The fill would be placed in maximum uncompacted lifts of 1 foot. All boulders larger than 1-foot diameter would be removed from the fill. Any wetlands within the Starter Dam footprint not filled during construction of the seepage collection system (see next section) would be filled with Starter Dam fill material. During Starter Dam construction, a temporary water reclaim/storage pond would be constructed upstream from the Starter Dam to hold water until the Starter Dam was complete.

The upstream portion of the Starter Dam fill would have low permeability material up to an elevation of 3,460 feet to limit seepage losses from the initial startup water pond. Above an elevation of 3,460 feet, seepage control would be provided by a spigotted tailings beach and seepage collection drains.

Soft, clayey material is present beneath the south abutment of the Starter Dam. A portion of the clayey material would be excavated, stored within the disturbance area, most likely borrow areas, and backfilled with compacted fill to act as a "shear key" for stability (Figure 9). A shear key is an area excavated beneath the dam. Up to three shear keys (100 feet long by 35 feet wide) may be required under the final dam footprint. The extent of the glaciolacustrine clay and its strength would be assessed during final design to optimize the location and extent of the shear keys. Other soft, unsuitable materials, such as wetland soils within the footprint of the Starter and Main Dams, would be either excavated and transported as backfill for the borrow areas, or filled with suitable foundation material, such as general fill from borrow areas or Diversion Dam excavation. Final design for management of these types of materials would be submitted to the agencies for approval. A high-density, polyethylene (HDPE) geomembrane liner would be placed beneath the tailings impoundment, up to an elevation of 3,460 feet, and keyed into the low permeability zone of the dam (Figure 8 and Figure 9).

#### *2.4.1.5.4 Seepage Collection*

In the 1992 and 1993 RODs and the DEQ Operating Permit #00150, the lead agencies required Noranda to modify the impoundment design to minimize the seepage from the tailings impoundment to the underlying ground water. MMC incorporated this requirement into the current tailings impoundment design. A seepage collection system would collect seepage from in

and around the tailings impoundment. The collection system would consist of a Seepage Collection Dam and pond, underdrains beneath the dams and impoundment, blanket drains beneath the dams (Figure 9), and pumpback well system. The seepage collection system would be constructed concurrently with the Starter Dam.

The impoundment underdrain system would consist of a two main trunk drains, and a series of secondary lateral drains (Figure 8). One of the main drains would follow the former Little Cherry Creek channel. The lateral drains would be spaced 300 feet apart and would be constructed in the old stream channel, adjacent wetlands, and upland areas in the impoundment. The lateral drains would convey water to the main trunk drains, which would then convey water to the Seepage Collection Pond (see below). The lined water storage pond behind the Starter Dam would not have an underdrain system, but the main trunk would pass under the lined area to the toe of the Main Dam. To facilitate the construction of the trunk lines in the former Little Cherry Creek channel, compacted fill material would be placed in the former channel to facilitate the preparation of the main trunk drains. During construction of the seepage collection system, any wetlands uphill of the Main Dam would be filled. All drains would be placed in a geomembrane-lined trench and consist of a core of highly pervious 1- to 4-inch rock wrapped in geotextile and surrounded by sand and gravel filter material. Locally available sand and gravel alluvial material would be used to cover the drains to prevent the fine tailings from piping into the drain materials during operations.

The underdrain system beneath the Starter and Main dams would use the same design as the trunk drains. The majority of the system would be constructed along and in or above the former stream channel alignment. Lateral lines would be installed in the dam footprint and would be tied to the main trunk drains. The former stream channel and connected wetlands would be filled with sand material to provide a sand bedding to meet trunk and lateral drain design specifications. Blanket drains would be used to control the phreatic (water saturation) level within the Starter Dam, Seepage Collection Dam, North Saddle Dam, the South Saddle, and the Diversion Dam. The blanket drains would be placed under the downstream one-third of the dam footprint (Figure 9). Construction of the blanket drains would consist of a 3-foot thick sand filter and a sand/gravel drain.

After the Diversion Dam and Channel were operational and Little Cherry Creek was diverted, a Seepage Collection Pond and Dam would be built across former Little Cherry Creek, about 100 feet downstream of the tailings impoundment. The dam would collect seepage and runoff from the tailings impoundment (Figure 8). The dam would be designed as a homogeneous fill dam with a downstream toe filter/blanket drain. The dam would have 2.5H:1V slopes and a 30-foot-wide crest at an elevation of 3,325 feet (Figure 9). The final elevation of the dam would be controlled by the available storage developed by borrowing material from the interior of the pond. The pond would be lined with clay or a geomembrane to achieve a permeability of less than or equal to $10^{-6}$ cm/sec. The pond would be designed to hold one week of flow from the underdrain system and runoff from a 100-year/24-hour storm, or 2.6 acre-feet. An emergency spillway would be constructed in the right abutment of the Seepage Collection Dam. Water collected by the Seepage Collection Dam would be piped to the tailings impoundment and returned to the mill for reuse. The reclaim pumping system would be able to pump up to 2,000 gpm back to the impoundment.

MMC has committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards. Seepage pumpback wells could be installed along the downstream toe of the tailings dam. Given the heterogeneity of the foundation

soils, additional wells could be required to ensure that all of the flow paths were intercepted. The wells may require active pumping, depending on the artesian pressures within the wells (Klohn Crippen 2005).

#### 2.4.1.6 Electrical Power

Electrical power required for fans, pumps, mining equipment, and surface construction during the initial preproduction phase would be supplied by two 1,250-kW diesel generators located at the shop building at Libby Adit Site (Figure 6). The generators would be sized to provide sufficient power until the 230-kV transmission line was installed. One generator would be the primary source of power, while the other would provide backup power if needed. A buried 34.5-kV transmission line along Bear Creek Road and the Ramsey Plant Access Road may be installed to replace the generators prior to the installation of the main transmission line. If the buried 34.5-kV line were installed, the generators would be used as standby power during construction operations. Flathead Electrical Cooperative would provide power to MMC.

To provide power to the Libby and Ramsey adit activities, a temporary substation would be installed near the intersection of NFS road #6210 and the Ramsey Plant Site Access Road (Figure 7). If constructed, the 34.5-kV line along Bear Creek Road and the Ramsey Plant Access Road would connect to this substation. Power would be distributed from the temporary substation to the Libby Adit Site and Ramsey Plant Site. For full operations, a 230-kV transmission line would be installed that ties with the Noxon-Libby transmission line near Sedlak Park (Figure 2) to the Ramsey Plant Site Substation (Figure 5). When the Sedlak Park Substation was built and the main 230-kV transmission line (discussed under section 2.8, *Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative)*) was installed, the temporary substation would be relocated to the Ramsey Plant Site. One of the generators on the Libby Adit Site then would be relocated to the Ramsey Plant Site and provide standby power for mine operations, the remaining generator at the Libby Adit Site would no longer be required and would be removed from the site.

### 2.4.2 Operations Phase

#### 2.4.2.1 Mining

##### *2.4.2.1.1 Ore Body Characteristics*

The ore body is composed of two nearly parallel mineralized horizons that range from 14 to 140 feet thick and are separated by an average of 30 feet of waste rock called the barren zone (Figure 10). The average thickness of the lower horizon (the B ore zone) is about 34 feet, while the average thickness of the upper horizon (the B1 ore zone) is about 30 feet. The ore body outcrops near the northern end of Rock Lake, and plunges about 15 degrees to the north and northwest. The ore body may extend farther to the north and northwest. Overburden thickness ranges from 0 feet at the ore outcrop near the northern end of Rock Lake to more than 3,000 feet near St. Paul Lake. The ore consists of quartzite, silty quartzite, and siltite of the lower Revett Formation. Section 3.8.2.1.3, *Geology of Analysis Area* provides a more detailed discussion of the ore body geology. Rock strength tests were conducted on samples collected from drill cores collected in the early 1980s. Data from the test work was used in mine design, pillar sizes, and other important criteria.

#### *2.4.2.1.2 Mining Method*

The ore deposit would be mined using conventional room-and-pillar methods, with both diesel and diesel-electric underground equipment. A room-and-pillar method is where some ore is not mined to provide pillars or columns of ore (Figure 10). MMC's preliminary mine design is based on a rigid-pillar approach. Rigid-pillar design means that all the pillars are designed to carry loads in excess of their strength and are designed not to yield. Different pillar types, based on their location within the deposit, are planned to support the overburden ceiling.

Preliminary mine planning has been based on a standard pillar size of 40 feet wide by 60 feet long, laid out in a regular grid basis (Figure 10). Average mining height of 48 feet and a panel width (area between pillars) of 40 feet were assumed for initial mine planning. Until a sill analysis can be conducted, pillars would be aligned between the upper and lower zones. Initial estimates indicate 65 to 75 percent of the mineable reserves would be removed. Actual pillar sizes would vary depending on the ore thickness, overburden thickness, local rock quality, and hydrologic conditions. MMC would develop the final pillar design after the Libby Adit and subsequent underground testing were complete.

As part of the Libby Adit evaluation phase, MMC would conduct additional underground core drilling before developing final mine plans. The drilling would be used to collect detailed information on underground geologic structures, ore thicknesses, ore grades, and hydrology.

Initial mine development would start in the central section of the deposit. Mining would progress generally toward the outcrop area and take 7 to 8 years to reach the upper portion of the deposit near Rock Lake. MMC would stop mining 500 feet from Rock Lake and 100 feet from the Rock Lake fault (Figure 11). It is expected that the Rock Lake Fault varies in structural thickness. Drilling would define the fault zone and establish the starting point for the 100-foot barrier in advance of approaching the buffer zone. Before the final barrier pillar design/location is completed, MMC is not proposing to mine within this 100-foot buffer zone but would conduct hydrologic and geotechnical studies to determine whether closer mining could be safely conducted. The following parameters would be determined by exploratory drilling ahead of development and flow testing:

- Fault location and slope
- Hydraulic conductivities and storage capacities for the fault zone and adjacent transition zones
- Width of the fault and transition zones
- Water pressures in the fault and transition zones

Similar studies would be conducted on the Rock Lake barrier pillar if mining were proposed closer than 500 feet to Rock Lake. These studies would be reviewed by the lead agencies and approval would be required before MMC could mine within a smaller buffer area. Microseismic and conventional monitoring would be used to evaluate long-term stability. Monitoring sensors would be located in operating and abandoned sections of the mine. The sensors would be connected to a continuous monitoring system and would record the size and approximate location of seismic events.

During full production, ore would be hauled from the ore passes to the primary underground crusher using 26- and 50-ton electric haul trucks. Crushed ore would be sent to the ore stockpile

building via a 1,200-foot overland conveyor for further crushing and ore recovery (Figure 5). The conveyor crossing at Ramsey Creek would be completely enclosed to minimize fugitive dust and a secondary containment trough would catch falling rock to prevent ore from falling into Ramsey Creek. Spillage within the conveyor structure would be shoveled onto the belt or removed at clean out points at either end of the structure.

##### *2.4.2.1.3 Geotechnical Monitoring*

Geotechnical monitoring would be completed to collect rock mechanic data and geologic information that were pertinent to mine design criteria and employee safety. The geotechnical monitoring program would be an update to geotechnical monitoring procedures and methods specified in DEQ Operating Permit #00150 and the 1993 ROD. The program monitoring would include logging drillholes and mapping of the mine workings and surface features. Rock quality analysis would evaluate fracture and fault frequency, orientation, and other properties, rock strength testing for stress, strain, and strength, and in-situ geomechanical tests. Microseismic monitoring would be used to assess long-term stability. Microseismic monitoring would include installation of sensor stations in operating and abandoned sections of the mine, and continuous monitoring of sensor stations. Stress monitors would be located near or on faults, barrier pillars, sill pillars, and other important structures/features. Data would be compiled, assessed, and reported to the lead agencies in an annual report.

The monitoring plan would be developed as mine activities were initiated during construction. Mapping would be completed as the adits, development, and mining activities progress. Drilling would be completed as part of the delineation drilling program that would occur in advance of mine development and mining. The core would be available to assess fractures, faulting, and establish if the monitoring plan should be modified to include any new features or address any new issue.

#### 2.4.2.2 Milling

##### *2.4.2.2.1 Ore Processing*

The mill would operate 7 days per week, 350 days per year for a total processing capacity of 7 million tons per year (20,000 tons of ore per day). Initial production would be 12,500 tons per day (tpd). The milling process would involve five major steps: crushing, grinding, flotation, concentrate dewatering, and tailings storage (see Figure 24 in MMC 2008). Crushing would occur underground while the remaining processes would occur in the mill facility. Reagents added during the flotation process would separate the copper and silver minerals (sulfides) from the host rock (generally quartzite), producing a copper-silver concentrate.

Ore would be processed into a concentrate using a conventional milling process known as froth flotation. In froth flotation milling, finely ground ore is mixed with water and various reagents and air is forced through the mixture in a series of large tanks called flotation cells. Sulfide minerals, such as copper, attach to air bubbles (or froth) that float to the top of the cell and are skimmed off the surface of the flotation cells and collected. Silver is found in its native form and is attached to the sulfide minerals, such as bornite, associated with the ore deposit. Silver would be collected concurrently with the sulfide minerals. Potassium amyl xanthate would be used as the collector and methyl isobutyl carbinol as the frother. These would be the only reagents required for flotation of the Montanore ore minerals. A polyacrylamide flocculant, such as Percol 352, would be used to assist the settling of the concentrate and the fine fraction of the final tailings in their respective thickeners. Percol 352 contains acrylamide, a regulated volatile organic

chemical in Montana. The proposed reagents are the same reagents used at the nearby Troy Mine. Material safety data sheets for the proposed reagents are presented in MMC's Plan of Operations (MMI 2005a, MMC 2008).

The non-mineralized rock, called tailings, which would consist mainly of quartzite, would sink to the bottom of the flotation cells (see section 2.4.2.3, *Tailings Management*). Bench-scale testing of Montanore Project ore and evaluation of the Troy Mine milling process, which processes an ore similar to Montanore ore, indicate that the mill process would operate at a near neutral pH. MMC does not anticipate the need for pH control. Process chemicals may be required periodically for testing, pH modification, or cleaning the flotation circuit and other process circuits in the mill. The flotation process would continue through cleaner flotation cells and would be repeated several times to improve mineral recovery and concentrate quality. After the flotation circuit, the concentrate would be sent to a dewatering system and stored until it was transported to the Libby Loadout (Figure 12) for shipment to the smelter. The concentrate would be the final economic product of the milling process.

#### *2.4.2.2.2 Concentrate Shipment*

After dewatering, the concentrate would be stored in a covered building and then loaded into 20-ton, covered, highway trucks by a front-end loader. Truck covers would be used to minimize loss of concentrate. At peak production, about 420 tons of concentrate, or 21 trucks per day, would be trucked daily via NFS road #4781, a new access road (the Ramsey Plant Site Access Road) (Figure 3), NFS road #278 (Bear Creek Road), reconstructed sections of NFS road #278, and U.S. 2 to Libby, and then to an unnamed road accessing the Kootenai Business Park to a loadout facility. The loadout would be next to the Troy Mine loadout.

Concentrates would be stored at the loadout inside an enclosed building with rail access on private land at the Kootenai Business Park in Libby, Montana, (Figure 12) and then shipped via rail to a smelter. For storage and handling of concentrates, a new building would be erected and either an existing concrete pad or a new pad constructed for the building would be used. The facility would be covered to eliminate any precipitation and runoff issues. Trucks would back onto a concrete pad and dump concentrate into the concentrate building. A front-end loader would stack the concentrate in the building for shipping. Rail cars would be loaded by a conveyor belt fed by a front-end loader. Dust control devices would be used during rail loading activities to minimize fugitive dust. The rail car would be located inside an enclosed area to minimize fugitive dust associated with concentrate handling and loading. The openings of the rail car loadout building would be covered with heavy plastic strips or other similar devices. The railroad track would be extended to permit storage of rail cars. Covers for the rail cars would be used to minimize loss of concentrate.

MMC and the Kootenai Business Park have signed a letter of intent to operate the loadout facility. During final design, MMC would finalize this agreement and discuss retention of the facility for future use by the Kootenai Business Park. For purposes of planning, Kootenai Business Park and MMC expect the building would be retained.

### 2.4.2.3 Tailings Management

#### *2.4.2.3.1 Tailings Pipelines*

Tailings from the milling process would be separated at the mill and tailings impoundment into coarse-textured sand (sand tailings) and fine-textured clay (fine tailings) fractions. The sand

fraction and water would flow as a slurry by gravity through a 10-inch diameter double-walled, high-density polyethylene (HDPE) pipe on the surface from the mill 6.4 miles to the tailings impoundment, where the slurry would be sent to cyclone separators (cyclones) for further separation of dam construction material. As a backup, a second sand fraction tailings line from the mill to the impoundment would be used. Fine tailings from the mill would be transported to the tailings impoundment through a 14-inch double-walled, HDPE or equivalent type pipeline. Reclaimed process water would be returned to the mill from the tailings impoundment in a 14-inch to 16-inch HDPE pipe or similar pipe (Figure 13).

The fine tailings would flow to a thickener northeast of the mill (Figure 5). Thickener overflow (water) would be diverted directly back into the process circuit or to the mine/yard pond (see section 2.4.2.4, *Water Use and Management*). All pipelines would be routed in part on the ground surface along the existing road (Figure 3). A pump station would be needed at a low spot near a new Poorman Creek bridge (Figure 13). This pump station also would pump tailings and water to the tailings impoundment to clear the line in the event of a temporary shutdown due to mechanical or power failure.

MMC has designed measures to prevent or mitigate ruptures in the tailings pipelines. MMC would construct a second sand fraction tailings line to use when the first line was in need of repair or replacement. The pipelines would be double-walled and fitted with air release/vacuum valves to ensure consistent flow. An automated leakage sensing system would continuously monitor line operation. If the system detected a leak, the mill and tailings transfer station would shut down. The surface pipelines between the mill and the tailings impoundment would be visually inspected each shift. An additional inspection would take place during scheduled maintenance shutdowns. The pipelines would be routed in a 24-foot-wide flat bottom ditch to contain any leakage from the pipelines. An unlined 6-foot-wide ditch paralleling the entire length of the road and pipelines would intercept any released tailings (Figure 13). Containment and surface water runoff ditches would be constructed with an earthen berm between them. This berm would ensure that in the event of a rupture of the double-walled pipe, all tailings would remain in the ditch and not come in contact with surface waters. A lined flume and trestle would be constructed (Figure 13) where the pipelines would cross Poorman Creek.

#### *2.4.2.3.2 Main Dam and Saddle Dams*

The tailings impoundment would consist of four primary structures: Starter Dam (discussed in section 2.4.1.5, *Tailings Impoundment*), Main Dam, North Saddle Dam, and South Saddle Dam (Figure 8). The Main Dam would be a compacted cyclone sand dam constructed by the centerline method to an elevation of 3,718 feet with a crest width of 30 feet, and downstream slope of 4H:1V (Figure 9). It would be constructed over the Starter Dam. The maximum dam height would be 318 feet and the final crest length would be 5,200 feet. The dam would be raised using up to 30 million tons of cyclone underflow (sand tailings) hydraulically placed and compacted in cells. The cyclone overflow (fine tailings) would be discharged in the impoundment to form a tailings beach on the dam face, forcing water away from the dam. If necessary, mine waste rock would be used in dam construction to supplement the volume of cycloned sands.

The sand shell of the dam would be constructed by hydraulic sluicing of the sand into cells oriented parallel to the dam crest. Dikes of sand pushed up by bulldozers would confine the perimeter of the cells. The cells would range between 100 feet to 150 feet wide, up to 400 feet long, and a maximum of 3 feet thick. Cell construction would begin at the toe of the dam and progress back and forth across the dam face until the downstream slice reaches the dam crest. For

each year of construction, sand placement would start at the downstream toe of the dam and be raised up the dam slope to the required crest elevation. Because the final crest elevation would not be achieved until October at the end of each season, each year's dam raise would provide the required storage needed until October of the following year. This would ensure that adequate dam freeboard and tailings storage capacity would be available at all times.

A collection system would be installed at the downstream end of the cells to decant the runoff water and segregated finer tailings out of the cells. The outflow would be carried in a pipeline to the dam toe where the fines would be settled in the Seepage Collection Pond, prior to pumping the water back the tailings facility. When the sand built up at the discharge end of the cells to between 10 feet to 15 feet, the cell deposition would be advanced along the dam slope. The cycle would be repeated when the full length of the dam had been raised 10 feet to 15 feet.

The South Saddle Dam would be a combination of a compacted general fill starter and cycloned sands, and would be constructed in Year 8 (Figure 8). The starter would contain 280,000 cubic yards of general fill. General fill would be excavated from borrow areas within the impoundment area and available mine waste rock. A North Saddle Dam would be constructed of 170,000 cubic yards of compacted general fill material and would be constructed in Year 11 (Figure 8). A blanket filter and drain would be installed under the compact fill on the impoundment side or downstream portion of the North and South Saddle dams.

### 2.4.2.4 Water Use and Management

#### *2.4.2.4.1 Project Water Requirements*

MMC's projected water balance is an estimate of inflows and outflows for various project components (Figure 14). Actual volumes for water balance variables (*e.g.*, mine and adit inflows, precipitation and evaporation, dust suppression) would vary seasonally and annually from the volumes estimated. MMC would maintain a detailed water balance that would be used to monitor water use. MMC developed two balances, one that reflects expected "steady-state" mine and adit inflows into the mine and one that reflects anticipated peak inflows. Steady-state values are expected to be the average inflows over a long period of time (3 years or more). MMC estimates that 800 gpm in the steady-state water balance would flow into the mine and adits in Years 6 through 16; less inflow water (600 gpm) would be available in earlier years. At steady-state conditions, all inflows would be used for mill make-up water. A make-up water supply of up to 200 gpm year-round would be needed to supplement available water supplies under assumed inflows of 800 gpm.

In accordance with DEQ Operating Permit #00150, MMC would notify the lead agencies if long-term surface water withdrawals would be necessary. Ground water withdrawals from alluvial wells also would be covered under these requirements. MMC would modify the aquatic life monitoring plan to take into account such withdrawals. Withdrawals would not proceed until the lead agencies' approval of an updated aquatic life monitoring plan. MMC would not withdraw any surface water for operational use when flows at the point of withdrawal were less than the average annual low flow. In lieu of measured annual low flows, calculated low flows at the point of withdrawal using data from similar drainages, would be acceptable.

A water balance that used peak inflows of 1,200 gpm was developed to assess the need for and effect of discharge of excess water. In the winter, water not required for milling would be directed to the tailings impoundment for storage until the seasonal operation of the LAD Areas would

begin. During the summer months, water inventories would be reduced at the tailings impoundment through consumption and evaporation. If peak inflows of 1,200 gpm occurred year-round during Years 6 through 10, excess inflow (267 gpm) would need to be disposed. MMC proposes that disposal of 534 gpm (two times 267 gpm) over a 6-month period would be required at the LAD Areas (Table 8).

The lead agencies completed a ground water model to estimate mine and adit inflows. The model estimated that at full build out about 450 gpm would flow into the two Ramsey Adits, the Libby Adit, and the mine void (see section 3.10, *Ground Water Hydrology* ). If inflows were less than 1,200 gpm on an average annual basis, MMC would discharge less excess water than the 534 gpm (Table 8). To provide a range of potential inflow rates given the uncertainties in hydraulic properties and interconnection of bedrock fractures, the lead agencies are analyzing the effects of both 450 gpm and 1,200 gpm inflows.

**Table 8. Average Process Water Balance during Years of Peak Discharge, Alternative 2.**

| Mine-Related Facility | 800 GPM Inflow (gpm) | 1,200 GPM Inflow (gpm) |
|---|---|---|
| **Mine and Adit Inflows** | | |
| Total estimated inflows | 800 | 1,200 |
| Discharge to LAD Areas with any necessary treatment | 0 | 267 |
| Net inflow to mill | 800 | 933 |
| **Mill Inflow** | | |
| Net inflow from mine/adit | 800 | 933 |
| Stored water from tailings impoundment | 1,390 | 1,390 |
| Make-up water | 133 | 0 |
| Subtotal | 2,323 | 2,323 |
| **Mill Outflow** | | |
| Water transported with tailings | 2,314 | 2,314 |
| Water in concentrate | 9 | 9 |
| Subtotal | 2,323 | 2,323 |
| **Tailings Impoundment Inflow** | | |
| Precipitation | 461 | 461 |
| Thickener and cyclone under- and overflows | 2,315 | 2,315 |
| Water released from tailings consolidation | 281 | 281 |
| Runoff captured by seepage collection pond | 193 | 193 |
| Runoff captured by tailings impoundment | 46 | 46 |
| Subtotal | 3,296 | 3,296 |
| **Tailings Impoundment Outflows** | | |
| Dust suppression | 80 | 80 |
| Evaporation | 427 | 427 |
| Water stored in tailings | 1,374 | 1,374 |
| Seepage into ground water | 25 | 25 |
| Water recycled to mill | 1,390 | 1,390 |
| Subtotal | 3,296 | 3,296 |

Initially, construction activities would focus primarily on completing the Libby Adit if the Libby evaluation program is not approved by the KNF. Currently, MMC is permitted under MPDES

Permit MT0030279 to discharge water from three outfalls at the Libby Adit. If the Montanore Project is approved and after this EIS is completed, MMC could apply for additional discharge locations at the LAD Areas.

MMC proposes that mine and adit water discharged to the LAD Areas would receive treatment through the land application (*i.e.*, mine and adit water would not receive treatment prior to land application). The initial startup of the mill would require a large quantity of water. MMC would store sufficient water during construction to facilitate the mill startup process. The construction of the Starter Dam would be initiated concurrent with the Ramsey Adits development. Untreated water from the Ramsey Adits would be discharged to the lined mine/yard pond at the Ramsey Plant Site, or LAD Area 1 and 2 until the Starter Dam was completed. After the lined pond behind the Starter Dam was built, water from the Ramsey Adits would be conveyed to the lined water reclaim pond behind the Starter Dam until the desired water quantity was achieved. Once this level of water was achieved in the Starter Dam, Ramsey Adit discharges to LAD Areas 1 and 2 for treatment and disposal would resume. MMC would install a water treatment facility at the Ramsey Plant to meet necessary MPDES discharge limits.

During mine operations, the water reclaim pond would be maintained, within the impoundment area, at a minimum capacity of 30 million gallons for water clarification. Pond location would move throughout the life of the tailings impoundment but would remain along the approximate centerline of the tailings impoundment. Initially, the reclaim water pond would be located near the Starter and Main Dams and progress to the west. All lateral drains beneath the reclaim water pond would be underlain by either the geomembrane liner, or tailings before being covered with the reclaim pond. Water from the tailings impoundment would be pumped back to the mill in a 14-to 16-inch diameter, 1-inch-thick double-walled HDPE or similar surface pipeline that would parallel the tailings pipelines. Post-closure water use and management is discussed on page 74.

#### *2.4.2.4.2 Wastewater Discharges*

A current MPDES permit (MT0030279) has been issued to MMC for discharges from the Libby Adit Site (Figure 15). The permit allows discharges from three outfalls. The permit became effective April 1, 2006 and expires on March 31, 2011. The permitted outfalls are:

- Outfall 001 – percolation pond
- Outfall 002 – leach field consisting of three infiltration zones
- Outfall 003 – direct discharge via a pipe from the percolation pond to Libby Creek

During operations, MMC would maintain the permitted outfalls at the Libby Adit Site and would apply for additional outfalls for wastewater disposal. Potential wastewater discharges associated with Alternative 2 include:

- Seepage or percolation to ground water from LAD Areas 1 and 2
- Seepage or percolation to ground water from the Little Cherry Creek tailings impoundment)
- Surface water runoff and/or seepage from waste rock stockpile(s) at LAD Area 1
- Surface water runoff from the Ramsey Plant Site and portal

The EPA has established Effluent Limitations Guidelines (ELGs) applicable to mines that produce copper and silver and mills that use the froth-flotation process for the beneficiation of copper and silver (40 CFR 440.100). The following discharges subject to the ELGs would include, but not be limited to: mine and adit drainage, tailings impoundment seepage, tailings impoundment dam runoff, runoff and seepage for waste rock stockpiles, runoff from facilities constructed of waste rock if subjected to precipitation, and runoff of excess water from LAD Areas 1 and 2. The discharges would be regulated at an outfall in a MPDES permit. The following discharges would be subject to Montana's storm water regulations, but not to the ELGs: soil stockpiles, access roads, parking areas, and runoff or seepage of facilities not constructed of waste rock or tailings. Management of stormwater discharges are discussed in the subsequent section 2.4.2.4.4, *Storm Water Control.*

**Land Application Disposal**

MMC has constructed and operates a filtration treatment plant to treat adit and mine inflows from the Libby Adit. MMC has proposed to use the LAD Areas for treatment and disposal of adit and mine inflow water from the Ramsey Adits. MMC would dispose of adit and mine inflows during construction and operations at LAD Areas 1 and 2 between Ramsey and Poorman creeks (Figure 7) using spray irrigation techniques. As part of the overall water management plan, MMC would construct a water treatment plant if necessary to meet permit conditions established by the lead agencies. Depending on the alternative selected, this may be a separate water treatment plant at the Ramsey Plant Site or use the existing water treatment plant that exists at the Libby Adit.

Concurrent with the Ramsey Adit completion, MMC would construct a 10-acre lined surge pond at LAD Area 1 (Figure 7 and Figure 15). The surge pond would convey water to the spray irrigation system. During construction, mine and adit water from the Libby Adit could be discharged via the existing outfalls 001, 002, and 003 or LAD Area 1. MMC plans to install a pipeline from the Libby Adit area to the LAD Areas.

Wastewater would be disposed of through irrigation of 200 total acres at the two LAD Areas. MMC proposes to operate both LAD Areas concurrently, with the capability of irrigating at a peak rate of 534 gpm (267 gpm annually over 6 or 534 gpm, Table 8). The combined LAD Areas would have a capacity of 2,000 gpm of water during the 6-month growing season. If disposal of higher quantities of water were required due to greater than expected mine dewatering rates, the water would be stored in the tailings impoundment and/or discharged untreated to one or more of the supplemental LAD Areas (see section 2.4.2.4.3, *Excess Water Management*).

Each LAD Area would have above-ground irrigation pipes and sprinklers four to eight feet above the ground surface. The LAD Areas would require selective tree thinning to allow a 50-foot unrestricted spray radius around each sprinkler. Typical operation would cycle all sprinklers once per week and apply about one inch of water per cycle. The maximum application rate per sprinkler would be about 4 inches per month and 24 inches over the 6-month growing season. The average application rate is 0.04 inch per hour; the application rate would vary depending on climate and site-specific conditions. Additional detail about LAD operations is found in MMC's Plan of Operations (MMI 2005a, MMC 2008).

The LAD Areas would be 300 feet or more from any perennial stream (Figure 15). In addition, sprinkler systems would be designed so that areas within 100 feet of ephemeral drainages could be shut off during periods of surface water runoff. MMC is evaluating the option of using snow-making equipment to convert stored water into snow during the winter season. This snow would

be spread over LAD Areas 1 and 2. Snow-making would only be performed after an assessment was completed and approved by the lead agencies regarding potential for excess loading to LAD Areas 1 and 2 during the winter season.

Infiltration and/or runoff from stormwater on the waste rock stockpile at LAD Area 1 is subject to MPDES permitting requirements. MMC proposes to collect LAD Area 1 surface water runoff in an unlined ditch extending northward along NFS road #4781 and routed into an unlined sediment retention pond (Figure 7). A second unlined ditch and pond are proposed for runoff from LAD Area 2. These two ponds would be sized to contain runoff from a 10-year/24-hour storm event. An overflow from either pond is proposed to discharge pipe to Poorman Creek via overland flow. Seepage from unlined ponds would discharge to ground water. To reduce storm water-mine drainage commingling on the LAD Areas, runoff from undisturbed upgradient areas would be diverted around both LAD Areas. LAD Areas 1 and 2 would be used seasonally.

The Waste Rock Stockpile at LAD Area 1 would be a staging area for temporary and intermittent placement of waste rock during construction of the tailings impoundment dams. In addition, MMC anticipates minimal to no surface water discharges from LAD Area ponds due to the design capacity (10-year/24-hour storm event).

**Tailings Seepage**

As part of the conditions of DEQ Operating Permit #00150, MMC designed an underdrain system to collect tailings water from beneath the tailings impoundment to minimize seepage to underlying ground water (Figure 8). Water collected by the underdrain system would flow beneath the tailings dam, down a short segment of the former Little Cherry Creek, and be captured by the Seepage Collection Dam. MMC estimates 25 gpm of tailings water seepage would not be collected by the underdrains and would discharge to ground water.

**Stormwater Runoff from Ramsey Plant Site**

The Ramsey Plant Site and adit portal pads would be constructed with a combination of waste rock and native cut-and-fill material. The waste rock at the Ramsey Plant Site would be placed so that it was surrounded by native material, thereby preventing direct contact of surface water runoff with waste rock. Stormwater runoff from the top of the plant site pad area would be directed to a lined mine/yard pond (Figure 5). An unlined sediment trap near the portal area would convey runoff to the lined mine/yard pond. Runoff and seepage from the plant site fill slopes above Ramsey Creek would be collected in ditches and directed to an unlined sediment trap. The sediment trap would be designed to contain runoff from a 10-year/24-hour storm event. Excess water beyond the capacity of the trap would discharge to Ramsey Creek through a constructed discharge point. Seepage to ground water may be considered a discharge to ground water and subject to MPDES permitting requirements. MMC expects that a surface water discharge from the unlined sediment trap would be "intermittent" because, at build-out, most of the surface area of the pad would be covered with impermeable materials and any surface runoff would flow to the lined mine/yard pond. Water from the lined mine/yard pond would be used in the mill as needed. MMC expects a discharge to Ramsey Creek from exposed waste rock would only occur intermittently during construction.

#### *2.4.2.4.3 Excess Water Management*

The LAD Areas and tailings impoundment would be the primary wastewater storage and disposal areas. MMC would use a number of techniques for managing project-related inflows and discharges, such as the existing Libby Adit Water Treatment Plant, grouting fractures and joints to

reduce ground water inflows, storage in the tailings impoundment coupled with enhanced evaporation (evaporating water by spray irrigation, either at the tailings impoundment or LAD Areas 1 and 2), and LAD Area/Supplemental LAD Area. These techniques are briefly discussed in the following sections.

#### Libby Adit Water Treatment Plant

The Libby Adit Water Treatment Plant was designed to remove nitrate and could be used to treat 500 gpm mine and adit water. The existing infrastructure at the Libby Adit Site would allow piping of the water from the Ramsey Adit and mine workings via the Libby Adit. A series of collection sumps would be constructed to remove sediment prior to discharge to the water treatment plant.

Collection and segregation of "clean" ground water from normal mine drainage water in areas where large water inflows occur could reduce the volume of water requiring treatment. The technique involves drilling an array of holes into a water producing zone and directing the water into a collector pipe. The inflowing ground water would be unaffected by mining activities and could be discharged without treatment while maintaining compliance with the discharge permit limits. Segregation of water may be difficult and not practical or feasible. This technique would not affect the water balance, but could reduce the mine water volume needing treatment.

#### Underground Water Management - Grouting

The bedrock encountered by the adits and mine would have low permeability. Several large faults and many smaller fractures, capable of storing and transmitting ground water, would be encountered during mine development. To reduce the amount of water entering the adits and mining areas, MMC would grout areas where water was flowing into the adits and mine workings. Drilling would occur ahead of drift development to allow identification of potential inflows. Grouting would be used as the primary mechanism to reduce adit and mine inflows.

#### Tailings Impoundment Storage

An estimated 71 million gallons of water (220 acre-feet) would be required to initiate mill operations, and MMC plans to slowly build this water inventory during construction activities. The lined Starter Dam would be designed to hold the required amount of water for mill startup.

During Starter Dam construction, a temporary water retention structure upstream from the Starter Dam would be constructed to hold water temporarily until the Starter Dam was complete. Once the tailings facility was in full operation, MMC expects there would be ample storage capacity to hold excess water.

#### Winter Discharge/Supplemental LAD Areas

If necessary, LAD Areas 1 and 2 could be used in the winter months using snowmaking equipment for primary treatment of discharges. This method would be used sparingly as it would delay startup of LAD Areas 1 and 2 in the summer. MMC identified supplemental LAD Areas near the two Ramsey Creek LAD Areas 1 and 2 and the Little Cherry Creek impoundment for discharge of wastewater (Figure 16). Borrow pits at the tailings impoundment would be available for untreated water disposal and are anticipated to be required only to handle excess water or temporary increases in water during construction. If the borrow pits were used for land application, wastewater would be applied at a rate that would increase evaporation and plant consumption of water.

**Temporary Diversions**

Temporary diversion ditches within the tailings impoundment would be used to control water from undisturbed areas. If additional water were required, precipitation and snowmelt from undisturbed areas within the tailings impoundment could be directed to the tailings impoundment and then pumped back to the mill to meet make-up water requirements. In the event of surplus water, MMC would divert water collected by the temporary diversion ditches within the tailings impoundment, but above the expanding tailings pond. These ditches would divert surface runoff from undisturbed lands within the tailings impoundment perimeter into the Little Cherry Creek diversion, thereby reducing the amount of water entering the tailings impoundment.

**Enhanced Evaporation, Infiltration, and Dust Control**

Enhanced evaporation would be accomplished by spraying within the tailings impoundment and when land applying untreated water at the LAD Areas. Managing water through a sprinkling system would result in substantial evaporation during certain periods of the year. In addition to evaporation, the LAD Areas would provide infiltration where vegetation would consume some of the water applied. MMC plans to use water to control dust from the tailings beaches. This would consume/evaporate a portion of the water generated from the project.

### *2.4.2.4.4 Storm Water Control*

MMC has developed a Storm Water Management Plan (Geomatrix 2007a). Surface runoff from the Ramsey Plant Site would be mine drainage and would be directed to a collection ditch on the southern side of the Ramsey Plant Site (Figure 5). The water would then flow by gravity to a lined mine/yard pond sized to accommodate the 10-year/24-hour storm event volume (including sediment), 4 hours retention of the thickener overflow, and 3 feet of excess capacity or freeboard as a safety factor. The mine/yard pond would be lined with clay or a geomembrane to achieve a very low permeability (less than or equal to $10^{-6}$ cm/sec). Excess water in the pond could be used as mill make-up water or disposed at the tailings impoundment or LAD Areas (Table 8). The portal patio surface water would be storm water runoff and would be directed down the access road, through a culvert at the Ramsey Creek bridge toward the mine/yard pond. A unlined sediment trap would be constructed below the portal patio and would be sized to handle a 10-year/24-hour storm event.

A riprapped interceptor ditch would be constructed on the north side of the Ramsey Plant Site to divert surface storm water runoff from undisturbed areas above the mill (Figure 5). The flow would pass through culverts at the main access road and discharge 300 feet from Ramsey Creek.

MMC would be responsible for snow removal from all access roads and the Ramsey Plant Site. All snow and ice removed from the site would be deposited according to mine drainage water management plans, including being left at the Ramsey Plant Site or Libby Adit Site or hauled to LAD Areas 1 and 2 or tailings impoundment. All debris removed from the road surfaces except snow and ice would be deposited away from the stream channels. Snow removal would be conducted in a manner to minimize damage to travelways, prevent erosion damage, and preserve water quality. Culverts would be kept free of snow, ice, and debris. MMC would not use salt on the roads.

In addition to the temporary diversion of Little Cherry Creek at the tailings impoundment, a permanent diversion ditch would be installed adjacent to NFS road #278 to direct runoff from the tailings impoundment (Figure 8). Diversion ditches would be constructed to capture runoff down gradient from all disturbances. To minimize the impacts of sediment, sediment traps and other

appropriate Best Management Practices (BMPs) would be installed. Below the tailings impoundment, where possible, ditches would be directed toward the Seepage Collection Pond; otherwise, appropriate BMPs would be used to handle storm water that was not classified as mine drainage water. Collection ditches/berms would be installed around the soil storage piles to reduce soil erosion/loss and control sediment impacts. Interim and concurrent reclamation would be employed where possible to reduce sediment loading and enhance soil stability.

Storm water associated with disturbance activities at the LAD Areas 1 and 2 (*i.e.*, access roads) would be directed toward the main access road and managed as part of the storm water management system. A series of ditches and berms would be constructed to control runoff from the road surface. Other areas would use standard BMPs to reduce sediment loading and to control erosion. A run-on diversion would be installed up gradient of LAD Area 1 to minimize the amount of water that would enter the site. The access road would provide run-on control to LAD Area 2.

### 2.4.2.5 Fugitive Dust and Erosion Control

#### *2.4.2.5.1 Dust Control*

A plan for mitigation of air quality impacts associated with fugitive dust is provided in MMC's Application for Air Quality Preconstruction Permit (TRC Environmental Corp. 2006a). A final fugitive dust control plan would be developed and implemented. MMC would use BMPs during construction, operation, and closure to control wind and water erosion. All appropriate precautions would be taken to minimize fugitive dust from all construction and operation activities related to the project, including concentrate transfer and loading activities at the Libby Loadout. These measures would include watering or applying dust suppression agents on unpaved roads and work areas on an as-needed basis.

Dust emissions from ore crushing, conveying, and other handling activities would be controlled with water sprays, wet Venturi scrubbers, and enclosures. Such control devices would be included on the primary crusher located underground, the conveyor belt, and the ore stockpile located adjacent to the mill facilities.

MMC's expects that seasonally, dust control at the tailings impoundment would occur continuously, but the decision to operate sprinklers at the tailings impoundment would be made based on regular inspection of the tailings impoundment during the day and on-site weather criteria to be established as part of the fugitive dust control plan. The presence of visible emissions, observed through shift inspection of the tailings impoundment by environmental personnel trained in visual opacity monitoring and by shift operators staffing the tailings impoundment, would prompt sprinkler operation. In addition, specific thresholds for weather conditions such as wind speed, precipitation, and humidity would be developed as part of the fugitive dust control plan to indicate the potential for fugitive dust emissions to occur, prompting sprinkler operation. Weather conditions and sprinkler operations if required would be documented (TRC Environmental Corp. 2006a).

All transfer operations and storage areas at the Libby Loadout would be completely enclosed. Concentrate transported by haul truck to the loadout would be dumped in an enclosed storage bin, and then transferred to rail cars. Loaded rail cars waiting for consolidation into a unit train would be covered to prevent wind losses and water pollution. The potential accumulation of concentrate along the haul truck turn-around, at the concentrate storage area, and along the railroad tracks

would be limited, and would be managed by regular clean-up with sweepers (TRC Environmental Corp. 2006a). Ground water monitoring wells would be installed at the loadout (Figure 12). Regular visual inspections would be completed by site personnel on reclaimed areas to evaluate where fugitive dust emission control measures were in place and properly functioning.

##### *2.4.2.5.2 Erosion Control*

MMC would use standard BMPs for sediment control such as interim reclamation, diversions, berms, sediment fence, sediment traps and ponds, and straw bales. Revegetation practices would be used to control water erosion by providing a stabilizing cover. Interim stabilizing measures such as water sprinkling, mulch, and tackifiers would be used until vegetation becomes established. Sediment would be contained from processing and material handling operations in lined sediment control ponds. Soil would be salvaged in two lifts at the impoundment. Subsoil with increased rock fragment content would be placed on the 4H:1V tailings dam face.

Reclamation equipment would be worked along contours where possible to minimize creation of erosion channels. When work on slopes must be perpendicular to contours, crawler tracking or dragging would be used. Windrows of woody debris or logs would be placed parallel to slope contours and the bases of long fills.

Reclaimed sites would be inspected periodically throughout the reclamation effort to assess progress toward meeting reclamation objectives. Slopes would be visually inspected for rills, gullies, and slope failures and repaired as needed.

#### 2.4.2.6 Waste Management

Sanitary waste management would be the same for the construction and production phases. During the initial development phase, temporary, fully contained systems would be brought to the site. The self-contained units would be located at the Ramsey Plant Site and the Libby Adit Site. Once construction was completed or they were no longer required, the units would be removed from the sites.

During operations, MMC would install a closed sanitary system that would function similar to the self-contained units and would collect all gray and black water associated with the office, mill, and administration areas. MMC would install buried sewage tanks adjacent to the mill/office building complex and portable toilets would be located underground. Low-flow toilets and shower heads would be installed to minimize the amount of waste water generated. All sanitary waste would be pumped and disposed off-site. MMC anticipates one or two truck trips per week would be necessary to remove sanitary wastes.

Solid waste (excluding domestic/sanitary) would be transported off site to the Lincoln County landfill. No hazardous wastes would be generated by the operation. MMC would dispose of certain materials (ventilation bag, plastic pipe, lumber, and other similar materials) that were used for underground operations and that were damaged or exceed their useful life, would be placed in mined out sections of the mine. Records would be kept on disposal of materials underground and would include the general types of material disposed and the location of the disposal area in the mined out areas.

#### 2.4.2.7 Transportation and Access

Traffic to the mine would use U.S. 2 and the Bear Creek Road (NFS road #278) and would include employee commuting and weekday delivery of supplies (Figure 2). Access road maintenance, including weed control, would be MMC's responsibility, unless additional use by the KNF or other interests would warrant a cost-share agreement. This responsibility would revert to the KNF or road owner following project completion.

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278) and in each proposed permit area. With the exception of the Bear Creek Road, all open roads in the proposed operating permit areas would be gated and limited to mine traffic only. Some gated or barriered roads would be used throughout operations for mine traffic only. Table 9 lists only those roads whose status would change in Alternative 2. For example, NFS road #2317 is listed in Table 9 because a 0.96-mile segment is currently open and would be gated in Alternative 2. NFS road #5184 is not listed in Table 9 because it is currently closed and would remain closed throughout the life of the project.

##### *2.4.2.7.1 Bear Creek Road (NFS Road #278)*

The current Bear Creek Road has a chip-and-seal paved surface. In order for MMC and the public to use the road safely together, some upgrading and widening of the road would be required. MMC is proposing to do these improvements and maintain the road as part of the project activities. About 10 miles of the Bear Creek Road (NFS road #278), from U.S. 2 to the Bear Creek bridge, would be reconstructed to applicable road standards set by the either the KNF or Lincoln County. The road would be widened on its existing alignment and chip-and-seal paved. The roadway width would be 20 to 29 feet wide and designed to handle speeds of 35 to 45 mph. The disturbed area, included ditches and cut-and-fill slopes, is expected to be up to 100 feet wide. Road widening would be generally on the fill side of the road. Between U.S. 2 and the start of the proposed permit area boundary at Bear Creek, 79 acres would be disturbed. MMC would inspect the Bear Creek bridge for load capacity, but expects it would be sufficient for mine use. While NFS road #278 was upgraded in the first 2 years, the Libby Creek Road (NFS road #231) would be used for access.

Within the tailings impoundment area, the Bear Creek Road would be relocated and reconstructed in four locations (Figure 8). These sections, and non-realigned sections, would be chip-and-seal paved and the roadway widened to 20 to 29 feet, consistent with the road north of Bear Creek. About 0.5 mile south of the tailings impoundment area and west of the Bear Creek Road, MMC would build 1.7 miles of new single lane road that would connect the Bear Creek Road with the Ramsey Creek Road (NFS road #4781) (Figure 17). A new, single lane bridge over Poorman Creek would be built (Figure 13). Public access on Bear Creek Road would not be restricted. Public access to the new mine access road would be restricted to mine-related traffic.

**Table 9. Proposed Change in Road Status, Alternative 2.**

| NFS Road # | Road Name | Location | Existing Status | Length (miles) | Proposed Status |
|---|---|---|---|---|---|
| 2317 | Poorman Creek | LAD Area 1 | Open | 1.0 | Gated, mine traffic only |
| 2317B | Poorman Creek B | LAD Area 1 | No closure order, impassable | 0.8 | Gated, mine traffic only |
| 4781 | Ramsey Creek | Between LAD Areas 1 and 2 | Open | 0.7 | Gated, mine traffic only |
| 278X | Bear Creek X | LAD Area 2 | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 1.0 | Gated, mine traffic only |
| 5170 | Poorman Creek Unit | LAD Area 2 | Open | 0.2 | Gated, mine traffic only |
| 5186 | Ramsey Creek Bottom | LAD Area 2 | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Gated, mine traffic only |
| 278L | Bear Creek L | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.3 | Gated, mine traffic only |
| 1408 | Libby Creek Bottom | Tailings Impoundment | No closure order, impassable | 0.5 | Gated, mine traffic only |
| 5181A | Little Cherry Loop H Cowpath A | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.2 | Barriered, no mine traffic |
| 5182 | Little Cherry Bear Creek | Tailings Impoundment | Open | 1.6 | Gated, mine traffic only |
| 5183 | Little Cherry View | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.5 | Gated, mine traffic only |
| 6201 | Cherry Ridge | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 1.3 | Gated, mine traffic only |
| 6212 | Little Cherry Loop | Tailings Impoundment | Open | 1.4 | Gated, mine traffic only |
| 6212H | Little Cherry Loop H | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Barriered, no mine traffic |
| 8838 | Little Cherry MS 10377 8838 | Tailings Impoundment | Open | 0.2 | Gated, mine traffic only |

#### *2.4.2.7.2 Little Cherry Creek Tailings Impoundment Area*

The roads used to haul waste rock from the Libby Adit and the Ramsey Adits to the Little Cherry Creek Tailings Impoundment Area are shown on Figure 17. Except of a short segment of Bear Creek Road (NFS road #278) in the Little Cherry Creek Tailings Impoundment Area, mine haul roads would be restricted to mine traffic only. MMC would use a segment of the existing Bear Creek Road north of LAD Area 2 for mine haul. The crossing of the old Bear Creek Road across Poorman Creek would be built to accommodate the 100-year flow event and be constructed in compliance with INFS standards. It would either be a bridge or arched culvert. The crossing width would be consistent with the roadway width.

Besides the Bear Creek Road, Little Cherry Loop Road (NFS road #6212), NFS road #8838 and about a 1.6-mile long segment of NFS road #5182 are the only other roads within the tailings impoundment currently open to motorized access (Figure 17). Gates on the Little Cherry Loop Road (NFS road #6212) would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. NFS road #6212 would remain open to motorized access south of the proposed permit area boundary to the junction with Bear Creek Road. Gating the Little Cherry Loop Road (NFS road #6212) would restrict motorized access to NFS roads #5182 and #8838. At the end of operations, gates would be removed and motorized access reopened. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road.

Other NFS gated or barriered roads within the tailings impoundment that would be used during the construction, operation, and closure of the tailings impoundment include: #278L, #1408, #5181, #5183, #5184, #5184A, #5185, #5185A, #6201, #6212H, #8838, and #8841 (Figure 17). MMC does not anticipate using the following currently restricted or barriered roads within the proposed tailings impoundment operating permit area and they would remain closed: #1408 (disturbance boundary to #5181), #5003, #5181A, #6212H (disturbance boundary to #5181), #6201A, and #8838. MMC would have to consult with the KNF prior to removing the gates or barriers on these roads and using them.

About 7.5 miles of realigned and new road would be needed from the Bear Creek bridge to the Ramsey Plant Site. Motorized access to upper Ramsey Creek and the Poorman Creek Road (NFS road #2317) via NFS road #4781 would be restricted by a gate at the intersection of the Bear Creek Road and the Poorman Creek Road (NFS road #2317). A new bridge across Ramsey Creek would be built between the Ramsey Plant Site and the Ramsey Adit portals (Figure 3). The bridge would be sized to allow for a 50-year flow event. A temporary crossing from the Ramsey Plant Site to the Ramsey portal patio would be used and then removed following bridge construction. MMC would remove the bridge after it was no longer required to support mine operations and/or reclamation activities for the project.

### 2.4.2.8 Communications

Communications for the project would be provided by both a telephone system and a two-radio system. Telephone and data communications would be via new, buried utilities along the Bear Creek Road from Libby. MMC currently has radio communications to the Libby Adit Site and would use this system for secondary emergency communications. MMC is currently authorized to use the local county emergency radio system to communicate with emergency responders. In addition, a fiber optic line would be included on the transmission line and would provide

communications between the substations. No additional disturbance would be required for any of the communication systems for the project.

#### 2.4.2.9 Project Employment

Construction would commence during Year 1, with the hiring of 135 employees, and would last about 4 years (Table 10). Construction employment would peak at 155 employees during Year 2. During Years 3 and 4, construction employment would be 65 employees. Total operations employment during Year 1 would be 30 employees, and is expected to reach 450 employees from Years 6 through 16 of the project. The mine is expected to operate 24 hours per day, 7 days per week, for 350 days per year. Maintenance repair and security activities would be scheduled during the remaining 2 weeks of the year.

Much of the construction work would be equipment and specialty services required for the project development. Each vendor or supplier may have a local distributor or hire local construction employees to assist in the installation or construction of their particular piece of the project. MMC expects up to 80 percent of the construction workers would be hired locally. MMC is committed to local hire and would encourage contractors to use local hire where possible, including partnerships with local businesses. MMC would work with local job services and educational institutions to outline the types of jobs and skills necessary for training purposes.

**Table 10. Projected Project Employment.**

| | Construction | | | Production | | | |
|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 1 | 2-5 | 6-10 | 11-16† |
| Production Rate (tons per day) | 0 | 0 | 0 | 12,500 | 12,500 | 17,000 | 20,000 |
| Construction‡ | 135 | 155 | 65 | 65 | 0 | 0 | 0 |
| Operations | 30 | 130 | 246 | 246 | 246 | 450 | 450 |
| Total | 165 | 285 | 311 | 311 | 246 | 450 | 450 |

†Production would continue for 3 to 4 more years if 120 million tons were mined; much lower employment during the 10- to 20-year closure period.
‡Construction employment includes a 23-person crew for the transmission line construction.

### 2.4.3 Reclamation Phase

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Specific objectives are: 1) long-term site stability, 2) protection of surface and ground water, 3) establishment of a self-sustaining native plant community where applicable and possible, 4) wildlife habitat enhancement, 5) protection of the public health and safety, and 6) attaining post-mining land use. The reclamation plan would be periodically revised to incorporate new reclamation techniques and update bond calculations. Prior to temporary or final closure, MMC would submit a revised reclamation plan to the lead agencies for approval.

#### 2.4.3.1 Post-Mining Topography of Project Facilities

MMC would accomplish reclamation objectives by stabilizing disturbed areas during and following operations. MMC has developed specific plans for each disturbed area.

#### *2.4.3.1.1 Rock Lake Ventilation Adit*

The Rock Lake Ventilation Adit would be plugged with concrete and any surface disturbance regraded. The adit location is very steep and is likely bare rock; salvaging and replacing soil may not be feasible. If the site had salvageable soil and it could be safely removed, it would be salvaged and seeded. At closure, soil would be replaced and the area reseeded.

#### *2.4.3.1.2 Ramsey Adits and Portals*

Adit portals would be permanently closed upon completion of operations. Closure techniques would depend on whether water was produced at the opening. Dry openings would be sealed by using a concrete plug and backfilling with waste rock recovered from the portal patio. MMC would use water inflow data obtained during mining to predict the amount and quality of water expected from the adits. For entries producing water, a water-retaining plug would be installed in competent bedrock. Design of the water-retaining plug would be determined by hydrologic and geotechnical data. Water-retaining plugs may be located deeper into the adit than a dry plug; thus, mine entries from the portal to the plug would be backfilled. Final plugging design for "wet" openings would be prepared for lead agencies' approved before cessation of operations.

#### *2.4.3.1.3 Ramsey Plant Site*

The mill building, conveyors, bridges, administration offices, substations, and other facilities associated with this area would be dismantled and removed once they were no longer required to support mine operations or closure activities. MMC expects the majority of the Ramsey Plant Site facilities be removed, sold, scrapped, and/or disposed locally. Concrete foundations would be broken up and buried on-site. Inert materials would be placed underground for disposal and would be identified in the final closure plan. Buried utilities and pipelines would be left in place and the segment of the system that was exposed at the surface would be cut off 2 feet below the regraded surface and plugged.

The portal opening would be covered with material from the patio and graded to meet adjacent topography (Figure 18). The remaining portal patio area would be regraded to blend with the adjacent topography and promote runoff away from the disturbed area. The slopes would be graded to 2H:1V slope. The sediment control structure located below the portal patio would be regraded so it would not retain runoff once vegetative cover was established on this area. The access road from the Ramsey Creek bridge would be ripped and graded to match the surrounding topography. The bridge would be removed and the area regraded to minimize sediment loading to Ramsey Creek.

The Ramsey Plant Site would be constructed using a cut and fill sequence supplemented by a quantity of waste rock from the mine operations. Once all the buildings were removed, a portion of the fill material used to construct the mill site would be "pulled" back up the slope away from Ramsey Creek and placed into the cut side of the area. If the cut slopes were not stabilized by interim reclamation at plant closure, the slopes would be reduced to a 2H:1V slope. It is estimated that 87,250 cy of material would be graded during reclamation of the plant site. Internal roads and parking areas would be graded to blend in with the proposed final slope and revegetated using seeding and mulch. The Ramsey Access Road (NFS road #4781) would be reclaimed to pre-operation conditions.

#### *2.4.3.1.4 Libby Adit Site*

The DEQ currently holds a reclamation bond to cover reclamation of 11.6 acres at the Libby Adit Site, including plugging the adit, associated with its approval of Minor Revision 06-002. The KNF has not approved the activities described in Minor Revision 06-002 that may affect National Forest System lands. Activities associated with the Montanore Project that are outside the scope of Minor Revisions 06-001 and 06-002 would be a pipeline to LAD Area 1 and 2 from the Libby Adit Site, temporary utilities, and the road connecting the adit site with the tailings impoundment. Reclamation of the Libby Adit Site would follow procedures described for the Ramsey Plant Site. All structures would be removed, and above- and below-grade features would be resloped (Figure 19). The water well would be plugged in accordance with state regulations and all surface piping would be removed to below the ground surface. Internal roads and parking areas would be graded to blend in with the original slope and revegetated using seeding and mulch. Because the Libby Adit Site is on private land, MMC would maintain control of the property with a fence after mining was complete. The agencies would require a bond for long-term monitoring and maintenance, and possible long-term, post-closure water treatment in order to ensure ground and surface waters would be protected from unanticipated impacts.

#### *2.4.3.1.5 Waste Rock Stockpile and LAD Areas*

MMC expects all waste rock to be used in various construction activities. It is anticipated that no waste rock would remain at the LAD Area 1 stockpile after cessation of mining operations. Soil removed from this area prior to its use would be replaced, and the area revegetated.

The surge pond and sprinkler systems at LAD Areas 1 and 2 would be removed when discharge at the LAD Areas was no longer needed. MMC expects to use the LAD Areas after mining cessation to discharge tailings water (see discussion of Tailings Impoundment reclamation below). Any piping used to convey water from the operations to the LAD Areas would be removed and disposed offsite. Concrete outflow boxes would be broken up and buried on site. Surface disturbance from the access road, diversion ditch, and surge pond would be reclaimed and revegetated.

#### *2.4.3.1.6 Tailings Impoundment and Borrow Areas*

**Tailings Impoundment and Dams**

The basic reclamation plan for the tailings impoundment would consist of the following operations:

- Where possible, concurrently distribute soil and revegetate tailings impoundment dam lifts as completed during mine life. Trees would be planted on the reclaimed dam faces. Depositing sand-fraction tailings into the tailings impoundment during the final year of operation to produce the desired tailings gradient at closure (Figure 20).
- Drying the tailings impoundment surface by promoting natural drying/consolidation of tails, and evaporation. Revegetated areas on the tailings surface. If water quality meets applicable standards, tailings waters (supernatant of free standing water and water in the tailings mass at closure squeezed out of the tailings mass as the reclamation cap is placed) would be disposed through LAD Areas 1 and 2 or constructed wetlands peripheral to the tailings impoundment (see section 2.4.6.1, *Wetland Mitigation Plan*). If required, the Libby Adit Water Treatment Plant may be needed to meet MPDES permit limits.

- Grading the tailings surface as it dries enough to support equipment to eliminate any surface water ponding. The North Saddle Dam would be removed and the surface runoff from the reclaimed tailings impoundment surface would flow overland via a diversion ditch toward the northwest and ultimately into Bear Creek (Figure 20).
- Adding excess waste rock or borrow to help consolidate tailings, produce final reclamation gradients, and give structural support for placing the reclamation cover system.
- Replacing stockpiled soil salvaged from the site during construction in two lifts and revegetating all disturbances through seeding and planting.

All mechanical facilities associated with the tailings impoundment, including the above-ground pipelines, would be removed. All areas associated with the tailings impoundment would have soil replaced and revegetated following operations. The diversion structures for Little Cherry Creek above the reclaimed tailings impoundment would be reclaimed during operations and would remain, routing runoff into the permanent Diversion Channel to Libby Creek (Figure 20).

To minimize potential gully formation at the tailings dam crest, 83,000 cubic yards of riprap would be placed on the dam crest and uppermost part of the dam face. The coarse tailings portion of the dam face would be ripped and covered with 15 inches of rocky subsoil followed by 9 inches of topsoil. Nine inches of non-rocky subsoil followed by 9 inches of topsoil would be placed over the regraded surface of the tailings impoundment and the South Saddle Dam face. The riprap and rocky subsoil would either be excavated from within the impoundment footprint during impoundment and dam construction or excavated from borrow areas.

At closure, the tailings would continue to settle as the tailings consolidate, forcing some of the entrained water in the tailings mass to the surface. Dewatering activities would be implemented to remove this water while incrementally placing the reclamation cover as dewatering activities progressed. An estimated average of 4 feet of fill would be needed to create the proposed final grade needed before soil was placed on the tailings impoundment surface. The fill would either be excavated from within the impoundment footprint during impoundment and dam construction or excavated from borrow areas. It would take up to 20 years for settling and consolidation to stop and to complete the entire cover on the tailings impoundment surface. During operations, MMC would use conventional methods to estimate the amount of tailings settling. MMC would use the estimate to design the final reclaimed pond surface configuration and to determine the amount of earthwork that would be required. MMC anticipates that a shallow depression may form in the center of the tailings impoundment due to tailings settlement. Sand-fraction tailings would be used in the last year of operations to help create the final gradient needed. During grading activities, the depression would be filled with sand tailings, mine waste rock, and/or material from the North Saddle Dam. The amount of tailings consolidation would dictate the final soil and fill volume needed to meet plan designs and would be updated periodically during the life of the project.

During the last year of operation, when the tailings dam crest had been completed to its ultimate operating level, the remaining portion of the cycloned coarse tailings (370,000 cy) would be deposited into the impoundment along the eastern and southern sides of the impoundment and would form a berm. The berm would be graded to the northwest at a 0.5 to 1 percent slope (Figure 20). The final tailings topography would be contoured to direct surface water runoff toward Bear Creek. The North Saddle Dam would be removed so that runoff would drain from

the reclaimed tailings impoundment surface toward the Bear Creek drainage. MMC would design a riprapped channel to Bear Creek. The design would incorporate features that provide for stability of this transition zone so that sediment loading was not increased. Post-operation topography would be achieved primarily by spigoting arrangements in the final years of operation. A small, rockfill check dam would be located just beyond the northwest end of the reclaimed impoundment. The check dam would be designed for the 100-year storm event. Sediment would be removed from behind the dam, if necessary. The final runoff diversion ditch on the upper end of the tailings impoundment to divert water toward the northwest would be left (Figure 20). This ditch would be riprapped with rock to prevent erosion and would be designed for long-term stability. The ditch would be sized to convey the 100-year storm event.

#### Borrow Areas

The borrow areas would remain until the impoundment reclamation plan was completely implemented to ensure no fill material was required. The borrow area slopes would be reduced to at least a 2H:1V slope and graded to ensure storm water does not leave the borrow area. The bottom of the borrow pit would be ripped to reduce water retention. Once the areas were no longer needed, the areas would be covered with soil and reseeded.

#### Post-Closure Water Management

At the end of operations, excess water would be present in the tailings impoundment. The volume of accumulated water would vary monthly in response to precipitation and evaporation and discharges to the LAD Areas 1 and 2. To enhance the removal of water and tailings consolidation, the use of evaporation by spraying on the tailings impoundment surface or LAD Areas 1 and 2, or other approved methods would be employed.

Following cessation of mining, the tailings impoundment would be partitioned to provide an area for water storage. The water level within the tailings would be lowered so construction equipment can work on the surface. Dewatering the top few feet of tailings would be accomplished by promoting natural drying and evaporation. MMC anticipates some difficulty in dewatering the tailings in the center portion of the tailings impoundment surface containing the fine tailings. The tailings in this area would have low bearing capacity. Subgrade reinforcement, such as a geotextile, may be needed for construction equipment to work on the tailings surface. MMC estimates that 10 percent of the area would require this technique and would likely be focused in the area where the final impoundment pond existed.

Seepage through the tailings dams would continue following reclamation. The seepage collection system would remain in place. Seepage to the underdrain system is expected to decrease from 930 gpm to 200 gpm 10 years after closure, stabilizing at a rate of 50 to 100 gpm over a longer period (Klohn Crippen 2005). Seepage collected in the pond would be pumped to the tailings impoundment where it would evaporate, be distributed to LAD Areas 1 and 2, or be used to irrigate reclaimed areas. Seepage from the tailings not collected by the underdrain system is estimated to decrease from 25 gpm during operations, and 22 gpm at closure, to 17 gpm in the first 10 years after closure, and stabilizing at 5 gpm over the long term (Klohn Crippen 2005). The seepage would mix with the underlying ground water and be intercepted by the pumpback well system. MMC would operate the seepage collection and the pumpback well systems until water quality standards or BHES Order limits were met without additional treatment. Long-term treatment may be required if water quality standards were not met. The length of time these closure activities would occur is not known, but may be decades or more.

Following removal, the Seepage Collection Dam and Pond would be graded to blend in with the original slope (Figure 20). After water quality standards or BHES Order limits were met and the Seepage Collection Dam and Pond was removed, seepage from the underdrain system would flow down the former Little Cherry Creek drainage to Libby Creek. Seepage not intercepted by the underdrain system would mix with underlying ground water and flow to the former Little Cherry Creek or Libby Creek.

#### *2.4.3.1.7 Roads*

Roads retained after mine operations and reclamation plans are discussed in MMC's Road Use Technical Memo (MMC 2007). MMC's general road reclamation approach would be as follows:

- Bear Creek Road – The Bear Creek access road (NFS road #278), from U.S. 2 to south of the tailings impoundment, would not be returned to its pre-mine width and the roadway would remain 20 to 29 feet wide. Cut-and-fill slopes associated with widening the Bear Creek access road from U.S. 2 to the new Ramsey Plant access road would be reclaimed immediately following construction.
- New Roads – All new roads, except the Bear Creek access road, constructed for the project would be reclaimed, which includes grading to match the adjacent topography, obliterating the road prism. This would include all roads constructed for the project.
- Open Roads – Reclamation of open roads upgraded for operations previously open to the public use would be completed to allow the road to be retained and used in a manner consistent with the pre-operational conditions. The surface would be bladed and sediment control systems inspected and replaced, as necessary. The bridge on NFS road #6210 would be removed and would be reclaimed consistent with open roads.
- Closed or Restricted Roads – Closed roads used for mine operations would be reclaimed to pre-mine conditions. Access restrictions would be upgraded or installed (gates, kelly humps, etc.) as required by the KNF, and the road surface would be scarified and seeded.

Available soil would be salvaged from disturbed areas and redistributed on fill and cut slopes where possible. Where soils were not salvaged during road construction, the road surface would be scarified and prepared for seeding. Soil would not be respread on cut slopes in consolidated material. Resoiled slopes would be broadcast seeded or hydroseeded with the planned seed mixture, dozer tracked where possible, and fertilized and mulched as necessary. Seeding of trees and bare-root shrubs is not planned for the roads that were not completely obliterated. MMC would inspect sediment control features and repair or replace controls as needed.

### 2.4.3.2 Interim and Concurrent Reclamation

To maximize site stabilization, weed control, and early completion of final reclamation, MMC would identify appropriate areas each year for interim and concurrent reclamation. Interim reclamation would be conducted in areas where disturbance was required during construction and/or operations. Potential interim reclamation areas include soil stockpiles, road cut/fill sections, borrow pits, plant site fill slopes, and other similar areas. Concurrent reclamation would be completed in areas where mine activities were completed and where no additional disturbance was anticipated. Potential concurrent reclamation areas include the tailings impoundment dam

face, borrow pits, temporary roads, and other similar features. Interim and concurrent reclamation would be carried out using the same techniques, seed mixtures, and fertilizer types/application rates as described in the final reclamation activities for the project. Where possible, interim and concurrent reclamation would occur within the same year of disturbance. The necessity for additional reclamation in areas where interim reclamation had occurred would be evaluated by the lead agencies at closure.

### 2.4.3.3 Revegetation

Compaction and handling would be minimized as much as possible. Soil replacement depths would average 24 inches on the tailings impoundment dam and 18 inches on all other disturbed areas. Soils would be removed in two lifts on a portion of the tailings impoundment area. The areas selected for double lift salvage would have more rock fragments in the subsoil.

Before soil redistribution, compacted areas, especially the adit portal areas, roads, soil stockpile sites, and facilities area, would be ripped to reduce compaction. Ripping would eliminate potential slippage at layer contacts and promote root growth. Soil salvage and redistribution would occur throughout the life of the operation.

Selection of plant species for revegetation was based on pre-mine occurrence; post-operation land use objectives; establishment potential; growth characteristics; soil adaptation and stabilizing qualities; wildlife palatability; commercial availability; and expected moisture, temperature, and soil conditions. Two plant mixtures are proposed: one dominated by species typically found in moist, relatively cool sites, and one with species suited to a wider range of growing conditions. Seed mixtures may be modified, with the lead agencies' approval, due to limited species availability, poor seed quality, site differences, poor initial performance, or advances in reclamation technology. Forbs would not be used in seed mixtures used on roadsides to avoid attracting bears. Seed mixtures would be dominated by native species. Prior to reclamation, MMC would submit seed information such as seed content and germination testing results to the lead agencies. The lead agencies would adjust seed mixtures as appropriate for site conditions and to meet any KFP changes.

Seeding rates were designed to average 90 to 100 live seeds per square foot for drill seeding and roughly twice that for the broadcast seeding. Drill seeding would occur on slopes of 33 percent or less. Rocky slopes, areas where organic debris had been spread, or slopes greater than 33 percent would be broadcast or hydroseeded.

On slopes of 33 percent or less, the seedbed would be disced and harrowed. After seeding, straw mulch would be applied at 0.5 to 1.5 tons per acre and anchored with a straw crimper. Some hydroseeded areas of slopes steeper than 33 percent would be mulched with a cellulose fiber mulch and a tackifier. Fertilizer application rates would be based on soil tests; phosphorus fertilizer would be applied before seeding; and nitrogen fertilizer would be applied in growing seasons after seeding.

Tree and shrub seedlings would be planted in selected areas of the Ramsey Plant Site, the Libby Adit Site, and the tailings impoundment. Shrubs and trees would not be planted on soil stockpile sites, portal patios, or along road corridors. Planting density would be 435 trees per acre and 200 stems per acre for shrubs. Seedlings would be planted either continuously in strips on steeper slopes or in highly visible areas, or in randomly placed groupings on level to gently sloping areas. Containerized seedlings would be used when available. When bare-root stock was used, planting

densities would be increased by 10 to 15 percent, depending on planting success of containerized stock versus bare-root stock.

Interim revegetation would take place on certain disturbed areas, such as roads, stockpiles, transmission lines, pipelines, and other areas, to reduce erosion and sedimentation. These areas would be broadcast seeded with the interim seed mixture, mulched, and fertilized as necessary. As the tailings dam increased in height, only final slopes would be reclaimed using the permanent seed mixture. All other unreclaimed disturbances would be reclaimed within 2 years after mining completion.

If feasible, seed or plant materials would be collected on site, and soils used for planting trees and shrubs would be inoculated with mycorrhizae. Seeds of species preferred by grizzly bears may be collected and used to supplement existing seed mixtures. When available, blister-rust resistant species would be used.

### 2.4.4 Temporary Cessation of Operations

Although a temporary cessation of operations is not planned, uncontrollable circumstances may cause a short-term stoppage in operations. Temporary cessation of operations refers to the suspension of ore processing and/or mining for an anticipated period of up to 1 year. Major steps to be undertaken would include the following:

- Continuing mine dewatering
- Maintaining water management (including treatment, etc.)
- Maintaining all monitoring activities
- Clearing and repairing site drainage and sedimentation control structures to ensure proper runoff and sedimentation control over a sustained period of time
- Contouring and seeding areas susceptible to erosion
- Securing monitoring wells, pumps, and intake structures to prevent equipment damage
- Maintaining access roads to insure project access
- Inspecting, repairing, or replacing signs and fencing around the property
- Implementing a facility inspection program
- Controlling noxious weeds
- Continuing dust suppression activities on the tailings beach and dam face

MMC would maintain the operation so that startup could be initiated quickly when the situation causing the temporary closure was eliminated. Staffing levels may be reduced to levels necessary but would provide staffing and coverage properly to maintain the facilities and permit. MMC would notify the lead agencies 30 days prior to any project startup. If the temporary closure were required for an extended period of time (greater than 1 year), MMC would meet with the lead agencies to discuss the project and issues that should be addressed in a temporary closure plan. MMC would submit the temporary closure plan that would outline the specific activities necessary to provide interim protection of resources.

## 2.4.5 Operational and Post-Operational Monitoring Programs

MMC would conduct operational and post-operational monitoring and provide monitoring results to the lead agencies in the annual report for hydrology, aquatic life, tailings dam stability, and revegetation.

### 2.4.5.1 Hydrology

Surface and ground water would be monitored during operations at various locations throughout the project area. Ground water monitoring would consist of periodic ground water level measurements and collection of samples for laboratory analysis. Proposed monitoring well locations would be located above and below all major project facilities. MMC would install the ground water monitoring wells prior to mine construction to establish pre-construction conditions. If the lead agencies determined additional monitoring wells were required for land application in the tailings area, these would be installed prior to construction activities.

Surface water monitoring would be conducted during the life of the project in conjunction with monitoring of aquatic life. Surface water monitoring would consist of periodic streamflow measurements and collection of samples for laboratory analysis. Any adit discharge would be monitored for quality and flow. Water levels in the tailings impoundment would be measured periodically. Sediment sampling at LB 2000/L2 downstream of the confluence of Little Cherry Creek with Libby Creek would be conducted daily during construction activities, every other day during initial mine operation, and once per week during mine operations/reclamation.

MMC would implement monitoring at Rock Lake to estimate existing ground water discharge to the lake that would allow subsequent detection of small changes in discharge due to possible dewatering effects of the project. Water budget variables would be measured or estimated, including evaporation, precipitation, surface water inflows and outflows, ground water inflows and outflows, and continuous lake levels. The lake monitoring system design and evaluation would be coordinated with the lead agencies. If substantial increased mine inflows occurred near Rock Lake, MMC would submit continuous lake level data, weather permitting, and any other lake level data accumulated during the year, within 5 working days and would provide data and evaluation at an increased frequency as determined by the lead agencies.

MMC would collect monthly samples to establish pre-construction conditions in the Little Cherry Creek ground water wells from March, or as soon as weather permits, through November of the same year. Monitoring wells at LAD Areas 1 and 2 would be sampled monthly whenever mine water was discharged to the LAD Areas 1 and 2, and would continue for at least 1 year following the cessation of discharges. If nitrate or ammonia concentrations increased in ground water, MMC would notify the lead agencies within 2 weeks and initiate twice-a-month monitoring of all adjacent surface and ground water stations.

At the end of the first monitoring year and following submittal of the annual report, MMC would meet with the lead agencies to discuss the monitoring results and evaluate the effectiveness of the LAD system. Following the annual review, the lead agencies would decide whether a change in monitoring or operations would be required. MMC would present the details of the additional monitoring in the final water management/treatment plan to be submitted to the lead agencies for approval that may be deemed necessary based on the annual reviews.

MMC would prepare a report briefly summarizing hydrologic information, sample analysis, and quality assurance/quality control procedures following each sample interval. Data would be submitted to the lead agencies by MMC within a reasonable time (5 to 7 weeks) after each sampling trip. MMC would submit an annual report to the lead agencies summarizing data over the year. In the annual report, MMC would present a detailed evaluation of the data. Data would be analyzed using routine statistical analysis, such as analysis of variance.

#### 2.4.5.2 Aquatic Life and Fisheries

MMC would monitor aquatic insect and periphyton populations at nine sampling locations in the project area. Sampling locations would include one each in Ramsey, Poorman, Little Cherry, and Bear creeks, and five in Libby Creek. MMC would monitor during three periods: in April prior to runoff, in August during late summer flows, and in October prior to ice forming in the streams. MMC would monitor fish populations in Libby Creek at 2-year intervals in four stream reaches in lower Libby Creek. Population densities of each fish species captured during the monitoring would be estimated. The condition of all captured fish would be recorded. MMC would estimate the seasonal variation in fine sediment loading (embeddedness) at each sampling station using the "substrate score" methodology. If bull trout spawning or bull trout redds were observed at the four fish monitor stations (L1, L3, L9, and Be2), the surface embeddedness monitoring would be supplemented with the "McNeil Core" substrate sampling methodology, using five representative core samples.

MMC would measure background concentrations and document potential changes in the concentrations of cadmium, mercury, and lead in the fish of Libby Creek. Each year, for 5 years, MMC would collect 10 cuttbow trout, each greater than 4 inches in size, and 10 adult sculpins from Libby Creek at three stations. Collections would be completed during the late-summer to early fall low-flow period. Tissue samples, including homogenized flesh and skin from each fish, would be analyzed to determine cadmium, mercury, and lead concentrations. Thereafter, MMC would resample each site at a 3-year interval to document the trends in bioaccumulation of these metals. MMC would tabulate sampling data and present the monitoring results in the annual reports.

#### 2.4.5.3 Tailings Impoundment

The monitoring program consists of four primary areas to be monitored: milling and material production; water balance; geotechnical stability and dam construction; and environment and closure (Table 11).

Reconciliation of the mass balance would be carried out on an annual basis, in conjunction with the water balance. Milling, production, and cyclone records would be kept to document "as-built" conditions. Records of dam construction, including borrow, mine waste rock, and cyclone sand volumes would be maintained. During operations, annual surveys of the impoundment, including water stored of the pond, would be carried out to assist in the reconciliation of mass balance.

The water balance would be reconciled on an annual basis, in conjunction with the mass balance. Records of all flows would be reconciled and the water balance also would use the measured precipitation and evaporation rates on site and observations of areas of beaches and water ponds.

**Table 11. Tailings Impoundment Monitoring Program, Alternative 2.**

| Technical Area | Item | Monitoring Parameters | Frequency | Comments |
|---|---|---|---|---|
| Milling and Materials | Thickener underflow feed line to tailings impoundment | Tons and Gallons | Daily | Compiled monthly and reconciled on an annual basis with the water balance<br>Reconcile mass balance with density of tailings (dam and impoundment) |
| | Secondary cyclone feed line to dam. | Tons and Gallons | Daily | |
| | Secondary cyclone – underflow and overflow | Tons and Gallons | Daily | |
| | Water storage in impoundment | Volume of water | Annually | |
| Dam Volumes | Cycloned sand, borrow, and mine waste rock) | Tons and cubic years per year | Annually | Annual reconciliation of fill materials |
| Water Balance | Reclaim pumping rates (volume) | Gallons/day | Daily | Compiled monthly and reconciled on an annual basis |
| | Irrigation pump rates | Gallons/day | Daily | |
| | LAD application rates | Gallons/day | Daily | |
| | Underdrain collection flows | Gallons/day | Weekly | |
| | Precipitation | Inches | Daily | |
| | Evaporation | Inches | Daily | |
| | Approximate pond areas | Acres | Monthly | |
| | Approximate wet and dry beach and dam areas | Acres | Monthly | |
| Water Quality | Reclaim water | All parameters listed in Operating Permit #00150 or MPDES Permit MT-0030279 | Monthly | |
| | Mine water | | Monthly | |
| | Groundwater seeps | | Quarterly | |

| Technical Area | Item | Monitoring Parameters | Frequency | Comments |
|---|---|---|---|---|
| Geotechnical Stability | Piezometers<br>- Main dam (10)<br>- South dam (2)<br>- North dam (2)<br>- Diversion dam (2) | Piezometric levels | Monthly | Monitoring of potential pore pressures in the clay; and "normal" dam monitoring |
| | Inclinometers<br>- Main dam (3) | Deformation (inches) | Monthly | To be located in areas of potential clay |
| Dam | Material properties | Density and gradation | Weekly | A QA/QC program would be implemented to measure and monitor density and gradation |
| Environment | Dust | Visual | Monthly | Routine observations to document potential dust and wildlife use of area |
| | Wildlife | Visual | Monthly | |
| Closure† | Consolidation of tailings (10 - settlement plates) | Inches of settlement | Quarterly to annually | |
| | Piezometers in the impoundment (10) | Phreatic level | Quarterly to annually | |
| | Revegetation plots | Acres of replanting | Quarterly to annually | |

†The operational monitoring would continue for the decommissioning stage until "steady state" conditions were met. Frequency would progressively decrease to quarterly and annually.

Ground water monitoring wells would be installed downstream of the Main Dam and downstream of the Seepage Collection Dam. The ground water monitoring wells would be installed along the two representative hydrogeological sections of Libby Creek and Little Cherry Creek. The location of ground water monitoring wells would be determined during final design. The wells would be installed at various depths to monitor the main hydrogeologic units including both shallow and deep soil/weathered rock units. Additional wells would be installed downstream of the North Saddle Dam and South Saddle Dam, later in the life of the mine. A preliminary schedule of monitoring wells is presented in Table 11; final well number and locations would be determined during final design. Flow measurement weirs also would be installed downstream of the Seepage Collection Dam and, during operations, in any areas of observed flows. Flow in the Little Cherry Creek Diversion Channel would be measured monthly, and dam seepage flows would be measured quarterly.

During operation, stability monitoring would include the following:

- Piezometers in the dam foundation and fill
- Inclinometers extending through the potential clay units in the foundation
- Seepage monitoring

Electric piezometers would be installed in the dam foundation to measure pore pressures during construction, with particular attention to areas where the glaciolacustrine clay is present in the foundation. Appropriate "trigger" levels would be established, in conjunction with the detailed stability analysis, to provide a management tool to respond to higher than predicted responses. Piezometers also would be installed in the cycloned sand section to monitor the "drawdown" of cyclone water within the dam fill. The piezometers cables would be buried and led to a common readout station at the toe of each dam. Continuous data reading equipment would be installed.

Inclinometers would be used to monitor potential deformation of the dam foundation. The inclinometers would be installed in areas of glaciolacustrine clay and would be extended up through the dam fill. Quarterly observations of any seepage would be documented. The seepage observations would include evidence of piping, flow estimate, and water quality.

Construction QA/QC of dam construction activities would be carried out by a qualified consultant. Responsibilities of the site engineer(s) during construction would be detailed in a field manual prior to construction and would include standard field and laboratory quality control tests.

Observations would be taken and documented during operations, such as dust from the tailings beaches, including length of time dust was generated, and aerial extent of dried area. The use of the area by wildlife, such as waterfowl, also would be noted.

The monitoring program would continue into the closure stage, although the frequency of records would be reduced accordingly as steady state conditions were reached. The following monitoring would be carried out during the reclamation phase:

- Piezometers would be installed within the tailings impoundment area to monitor the progressive "drawdown" of the phreatic surface
- Settlement plates would be installed over the tailings impoundment area to monitor the consolidation/settlement of the tailings to help confirm predicted consolidation behavior for closure
- Monitoring of the success of the ongoing progressive revegetation program would be continued until steady state conditions were reached

Stability monitoring of the dam would be performed during operation and after closure. The downstream slope and toe of the tailings dam, the North and South Saddle dams, the Diversions Dam, and the Seepage Collection Dam would be visually inspected daily for evidence of seepage exiting the slope or the downstream toe. A V-notch weir would be located at the downstream toe of the dam to monitor seepage rates. If seepage were noticed, both the seep location and estimated quantity of flow would be recorded and the project geotechnical engineer immediately contacted for inspection and recommendation for mitigation measures, if necessary. During operations, the dam and associated structures would be inspected weekly and measurements taken of freeboard adequacy; beach width; cracking, sloughing, depressions, and erosion of the dam and abutments; changing trends in seepage quantities, piping, and wet spots; and the condition of the Diversion Channel.

#### 2.4.5.4 Air Quality

MMC has committed to implementing the monitoring requirements developed by the DEQ for the draft air quality permit. The monitoring plan is summarized in this section and discussed in

the DEQ's draft permit (DEQ 2006a). MMC would submit to the lead agencies for approval a general operating plan for the tailings impoundment site including a fugitive dust control plan to control wind erosion from the site. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement.

MMC would install, operate, and maintain three air monitoring sites near the mine and facilities. The exact location of the monitoring sites would be approved by the DEQ. MMC would begin air monitoring at the commencement of mill facilities or the tailings impoundment and continue air monitoring for at least 1 year after normal production was achieved. MMC would analyze for metals shown in Table 12 on the $PM_{10}$ filters once the mill facilities and tailings impoundment were operational. At that time, the DEQ would review the air monitoring data and determine if continued monitoring or additional monitoring was warranted. The DEQ may require continued air monitoring to track long-term impacts of emissions for the project or require additional ambient air monitoring or analyses if any changes took place regarding quality and/or quantity of emissions or the area of impact from the emissions.

**Table 12. Required Air Quality Monitoring, All Alternatives.**

| Location | Site | Parameter | Frequency |
|---|---|---|---|
| Plant Area | Site #1 | PM-10[1]<br>As, Cu, Cd, Pb, Zn[2]<br>PM-2.5[3] | Every 3rd day according to EPA monitoring schedule |
| Tailings Area (Up-drainage) | Site #2 | PM-10[1]<br>As, Cu, Cd, Pb, Zn[2]<br>PM-2.5[3] | Every 3rd day according to EPA monitoring schedule |
| Tailings Area (Down-drainage) | Site #3 | PM-10[1] / PM-10[1] Collocated<br>As, Cu, Cd, Pb, Zn[2]<br>PM-2.5[3] / PM-2.5[3] Collocated<br>Windspeed, Wind Direction, Sigma theta[4] | Every 3rd day according to EPA monitoring schedule<br>(Collocated every 6th day)<br>Continuous |

[1] PM-10 = particulate matter less than 10 microns.
[2] As = Arsenic, Cu = Copper, Cd = Cadmium, Pb = Lead, Zn = Zinc.
[3] PM-2.5 = particulate matter less than 2.5 microns.
[4] Sigma Theta = Standard Deviation of Horizontal Wind Direction.

### 2.4.5.5 Revegetation

MMC would complete soil tests to determine the appropriate fertilizer mix required for successful reclamation. The fertilizer mix and rate would be approved by the lead agencies before being used. Interim reclamation activities would provide opportunities to evaluate the most effective use of fertilizers for final reclamation. The vegetation cover, species composition, and tree planting success would be evaluated during the first year following reseeding or replanting. In addition to a general evaluation, MMC would conduct vegetation monitoring every 2 years during operations at sites representative of various types of disturbance. Control sites in areas unaffected by the project would be established to provide information on site conditions. Reports summarizing survey data would be submitted to the lead agencies. MMC would develop reclamation bond release criteria as part of the overall reclamation plan reviewed and approved

by the lead agencies. Part of the release criteria would involve specific, qualitative measurement of revegetation success.

At the end of mine operations, MMC would conduct similar vegetation monitoring every year at sites representative of various types of disturbance. The following characteristics would be evaluated:

- Plant species responses (germination, growth, competition)
- Total and vegetative cover
- Plant species and plant diversity (including weeds)
- Procedures to reclaim steep rocky slopes
- Soil redistribution depth
- Soil rock fragment content
- Effects of fertilizer rates
- Tree planting techniques
- Tree stocking rates
- Viability of bare-root versus containerized stock

MMC would request bond release in phases as specific tasks were completed. The following criteria for revegetation success and bond release would apply to areas where revegetation is the primary reclamation objective:

- Cover – Total cover was least 80 percent of the control site total cover, or the site met a total cover of 70 percent with at least 60 percent of that cover being a live plant community
- Diversity – Dominance by no more than three acceptable plant species, either in the seed mixture or the local native plant community
- Noxious Weeds – No more than 10 percent noxious weeds
- Rills and Gullies – No rills and gullies greater than 6 inches deep and/or wide

Success criteria must be met for 3 years to meet reclamation objectives. If success criteria were not met, MMC would modify seed types and reclamation techniques as appropriate and conduct a second seeding. If the site was stable but still did not meet vegetative release criteria, MMC may modify the plan and reseed again, and would request bond release by the lead agencies.

MMC would regrade and revegetate areas where rills and gullies exceeded the release criteria. If rills and gullies persisted, MMC would review run-on conditions and regrade and/or install sediment control features as appropriate. If site stability was still not achieved, MMC would consider armoring the rills and gullies with riprap, rock lining, or other similar materials to provide a stable drainage pathway. Once the site exhibited stability for 3 years, MMC would request bond release by the lead agencies.

Vegetative monitoring also would assess noxious weeds. Measures outlined in MMC's Weed Control Plan approved by the Lincoln County Weed Control District would be followed during operations and reclamation to minimize the spread of weeds to reclaimed areas. If weed content were above 10 percent, MMC would implement additional weed control methods and apply weed

control treatment for 2 years. If after 3 years, the percent of weeds at the reclaimed site were 50 percent of the control site's weed population, MMC would request bond release.

#### 2.4.5.6 Cultural Resources

All remaining un-inventoried potentially affected areas would be intensively inventoried for prehistoric and historic resources. If previously undiscovered cultural resources were encountered, work in the immediate area would stop, and the KNF and the State Historic Preservation Office would be notified. MMC would meet with KNF personnel to determine potential resource value and implement recordation and/or excavation program as required. Site documentation would be provided to the KNF. No additional disturbance would proceed until the lead agencies gave approval.

### 2.4.6 Mitigation Plans

#### 2.4.6.1 Wetland Mitigation Plan

MMC developed a conceptual mitigation plan designed to replace wetland functions and values lost as a result of the project. MMC would replace the existing forested and herbaceous wetlands affected by the project on a 2:1 basis. For example, 10 acres of forested or herbaceous wetlands would be created for every 5 acres of forested or herbaceous wetlands disturbed. Herbaceous/shrub wetlands and waters of the U.S. would be mitigated with wetlands at a 1:1 ratio. MMC identified 44.6 acres of possible wetland mitigation areas. MMC believes the identified mitigation would be more than the required mitigation acres and should provide flexibility in selecting mitigation by the lead agencies and the Corps. MMC would create or expand existing wetlands at the following locations (Figure 21):

On-Site

- Little Cherry Creek–2.2 acres
- Little Cherry Creek Diversion–1.6 acres
- Unspecified Little Cherry Creek Site–5 acres

Off-Site

- North Poorman–3.4 acres
- South Poorman–9.7 acres
- Poorman Weather Station–14 acres
- Libby Creek Recreational Gold Panning Area–2 acres
- Ramsey Creek–6.7 acres

##### *2.4.6.1.1 On-Site Wetland Mitigation*

On-site wetland mitigation would consist of 8.8 acres within the permit area boundaries. The Diversion Channel around the tailings impoundment would be designed to provide hydrologic functions and values similar to those provided by the conifer-dominated wetlands in riparian areas. MMC anticipates 1.6 acres of wetlands would be created in the Diversion Channel.

Two mitigation sites are proposed in the Little Cherry Creek drainage downstream of the tailings impoundment. One site, not specifically identified, would use ground water collected from beneath the tailings impoundment to create and maintain wetlands. Flows are expected in the range of 30 gpm and would be directed down low-gradient channels constructed to allow water to flow between and collect in a series of depressions. A complex of herbaceous/shrub wetlands of 5 acres would be created by directing these flows. The wetlands are anticipated to replace functions and values provided by existing herbaceous/shrub wetlands.

The other wetland mitigation site in Little Cherry Creek is along the northern side of the proposed tailings impoundment on land owned by MMC. This area contains a small existing wetland complex. MMC would increase the size of the existing wetlands through small excavations and dams that would retain water longer. MMC may use ground water collected from beneath the tailings impoundment, if needed. An estimated 2.2 acres of additional shrub-dominated wetlands might be developed at this site.

#### *2.4.6.1.2 Off-Site Wetland Mitigation*

About 35.8 acres of potential wetland mitigation sites have been identified near the project area but are outside the permit area boundaries: three sites in the Poorman Creek area, one site within the Libby Creek Recreational Gold Panning area, and one site along Ramsey Creek near the LAD Areas. The Poorman Creek sites include South Poorman, North Poorman, and Poorman Weather Station sites.

The proposed South Poorman site is adjacent to an existing 5.9-acre wetland. It could consist of 1.4 acres of new wetlands on the northern side of the existing wetland, and 8.3 acres immediately south of the existing wetland. The North Poorman site is adjacent to and north of a small existing wetland. About 3.4 acres of additional wetlands could be developed at this site. The Poorman Weather Station is not within an area of existing wetlands and has no well defined drainage. About 14 acres of new wetlands could be developed at this site.

All three Poorman sites have soils and terrain similar to that of the proposed Little Cherry Creek Impoundment Site. Wetlands would be developed through excavation of shallow depressions in locations where surface water would collect and be retained. Artesian wells would be developed to supply water if natural runoff were insufficient to maintain hydrophytic vegetation.

Two acres of newly constructed wetlands could be developed at the Libby Creek Recreational Gold Panning Area. Portions of the existing coarse placer piles would be removed, recontoured to expose ground water, and revegetated. These new wetlands would be shrub and forb dominated initially, but would eventually become conifer dominated. The Ramsey Creek site is located near the proposed LAD Areas 1 and 2. It is part of an existing human-made wetland area, and would be expanded by spreading out streamflow that feeds the site. MMC estimates this site could be expanded by an additional 6.7 acres.

#### *2.4.6.1.3 Monitoring*

To determine the success of the wetland mitigation, a monitoring program would be initiated after construction of wetlands to assess vegetation growth, hydrological conditions, wildlife use, and integrity of constructed wetlands. Vegetation growth would be monitored in June and August following the first growing season. Monitoring would continue until the Corps had determined that wetland plant communities predominate and the mitigation wetland was self-sustaining, or for a period of 5 years, whichever was greater. Less intensive monitoring would then take place

every 2 years thereafter until the end of operations. Species composition and canopy coverage would be recorded for constructed wetland plant communities. Growth of seeded and non-seeded (volunteer) species would be recorded. If seeded species did not become established, supplemental seedings and transplanting would be undertaken. If noxious weeds invaded wetland areas, they would be removed by mechanical methods or other methods approved by the Corps.

The hydrological status of wetlands would be monitored during spring and fall. Surface water depth would be recorded. If no surface water were present, test holes would be excavated to determine the depth of free water and saturated soil. Wildlife use would be monitored in the spring and late summer. Integrity of constructed wetlands would be monitored.

MMC would monitor any effects to existing wetlands downstream of the tailings impoundment. Monitoring of the downstream wetland areas would be completed annually for the first 5 years of mine operation. If functions and values of downstream wetlands were adversely affected, MMC, in cooperation with the lead agencies and the Corps, would develop additional wetland mitigation.

#### 2.4.6.2 Fisheries Mitigation

MMC proposed the fisheries mitigation developed collaboratively in 1993 by the KNF, FWP, Corps, and EPA to mitigate the fisheries impacts associated with the Little Cherry Creek diversion and the riprapped tailings impoundment overflow channel to Bear Creek. These impacts include the loss of recreational fishing opportunity and the loss of fisheries production in Little Cherry Creek. Before any other mitigation work was attempted, and immediately before closure of the Little Cherry Creek Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. MMC would design the Little Cherry Creek Diversion Channel, to the extent practicable, for fish habitat and passage. MMC's survey of the unnamed tributary to Libby Creek that would receive diverted water shows that most of the drainage would develop habitat comparable to Little Cherry Creek (Kline Environmental Research 2005a).

Other components of MMC's fisheries mitigation would include one or more of the following:

- Libby Creek Watershed — Conduct fish investigations to determine the genetics, distribution, and abundance of fishes of concern.
- Howard Lake — Construct paved access trails and three fishing platforms for physically challenged recreationists near existing facilities. Restrooms and other facilities would be modified to improve accessibility. Rehabilitate up to 100 feet of the lake outlet to provide spawning and rearing habitat, using pool-riffle control structures, overhead cover, clean gravels, and proper flow-depth controls.
- Ramsey Lake/Creek — Survey the upper reach of Ramsey Creek and Ramsey Lake for suitability as a trout species of concern fishery, implement habitat and barrier work as necessary, and stock with suitable type and number of fish. Construct a vehicle pullout, small parking area near the mill site accessible to motorized public, and a trail around the Ramsey Plant Site that leads to upper Ramsey Creek or Ramsey Lake.

- Libby Creek — Rehabilitate habitat upstream from the mouth of Howard Creek through creation of pool and hiding cover habitat, stabilization of old mining spoils, and channel narrowing; enhance habitat values in stream reach immediately downstream of the Libby Adit Site.
- Libby Creek Watershed — Conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks.
- Standard Creek — Survey upper reaches for rehabilitation opportunities. Implement habitat work to mitigate limiting factors. Stock with a trout species of concern. Construct an artificial fish barrier protection if needed.
- Snowshoe Creek — Survey upper reach for channel stabilization and habitat rehabilitation needs. Implement habitat and streambank work as needed to mitigate limiting factors. Stock with a trout species of concern. Liming of watershed to speedup recovery of an aquatic ecosystem may be required.
- Kilbrennan Lake—Rehabilitate the fish population in the watershed to create a self-sustaining wild trout population. Implement habitat rehabilitation work as needed based on a survey.

MMC would be responsible for maintenance of all fisheries mitigation projects until mitigation of fisheries losses were complete and accepted by the lead agencies. MMC would submit project surveys and designs for consultation and agencies' approval before implementation of any fisheries mitigation project. Five years of monitoring data indicating stable or increasing mitigation success would be required.

### 2.4.6.3 Grizzly Bear Mitigation Plan

The Montanore Project would affect existing grizzly bear habitat (see section 3.24.5.3, *Grizzly Bear*). The KNF's 1993 ROD revised the grizzly bear mitigation outlined in the 1992 Final EIS, and adopted the USFWS recommendation of a "reasonable and prudent" alternative identified in a 1993 Biological Opinion for the project. The USFWS' reasonable and prudent alternative is the basis for MMC's grizzly bear mitigation plan. The plan consists of habitat protection, measures to reduce mortality risks, and mitigation plan management.

#### *2.4.6.3.1 Habitat Protection*

Habitat protection would consist of three parts: road management, habitat acquisition, and management of patented mill claims. Each part is discussed briefly below. As part of its mitigation, MMC would request that the KNF implement access changes on the following two roads:

- NFS road #4784 (upper Bear Creek Road) would be closed year-long for the life of the project. The change would be at the location of the existing seasonal gate, which is 2.1 miles from the end of the road.
- NFS road #4724 (South Fork Miller Creek) would be closed on a seasonal basis (April 1 to June 30) for the life of the project. The change (6.6 miles) would be at the junction of the main Miller Creek NFS road #385.

MMC would purchase 2,826 acres of private lands to mitigate for habitat losses not offset by KNF's road access changes. MMC would complete all acquisitions within a 6-year period, beginning at the time of construction, with at least 50 percent completed within the first 3 years. Acquired lands would be approved by the KNF, in consultation with the USFWS and FWP. The location of acquired lands would be within the Cabinet portion of the Cabinet-Yaak Ecosystem. Preference would be given for lands within the affected Bear Management Units and lands along the eastern side of the Cabinet Mountains. For biological reasons, and because of the potentially limited amount of lands that may be available for acquisition within this area, lands within other portions of the Cabinet Mountain area of the Cabinet-Yaak Ecosystem may be considered. Any of the following could occur with the acquired parcels, including mill site or mining claims that MMC might patent as a result of the Montanore Project:

1. MMC may purchase the private parcels directly, and then transfer title to the KNF or other state or federal resource management lead agencies. If the KNF acquired these lands, they would be managed as Management Situation 1 grizzly bear habitat.
2. MMC may purchase the private parcels directly, and then transfer title to a private conservation organization, along with an acceptable conservation easement directed at protecting the land for use by grizzly bears.
3. MMC may purchase private lands directly, and then retain title to the lands, along with an acceptable conservation easement directed at protecting the land for use by grizzly bears.
4. In some instances, MMC may purchase a conservation easement with fee title remaining with the private party. Conservation easements generally would be established in perpetuity.

The KNF may, on a case-to-case basis and in cooperation with the USFWS and the FWP, accept conservation easements established for a fixed period of time extending throughout the life of the impacts. KNF would be given a chance to purchase the land before offering fee title of acquired lands to third parties. The KNF would seek a mineral withdrawal on any acquired lands to prevent future mineral entry. Under certain conditions, MMC might also be able to enter into a land exchange with the KNF, and in return receive lands outside of grizzly bear habitat. After the KNF, in counsel with the USFWS and the FWP, determines that project impacts have ended, the acquired lands could be used by others seeking mitigation for effects on grizzly bears, providing that acceptable conservation easements or other conditions are satisfied to protect these lands for use by grizzly bears.

Prior to construction activities, MMC would provide a $6,217,200 bond (based on $2,000 per acre) to the Forest Service to ensure adequate funding would be available for the required land acquisition. The bond would take into account any lands that MMC might have purchased prior to construction, providing that the Forest Service, in counsel with USFWS and the FWP, accepted such lands for mitigation. In the event that MMC forfeits the surety bond, MMC would be responsible for all legal fees incurred by the Forest Service. Completion of the acquisition program would be a provision of project approval and failure to comply could result in project shutdown. The bond would be reviewed annually to determine if the bond amount should be adjusted.

#### *2.4.6.3.2 Measures to Reduce Mortality Risks*

MMC would fund two new full-time wildlife positions, a law enforcement officer, and an information and education specialist, with duties aimed directly at minimizing effects on grizzly

bears. The estimated total cost would be about $3.1 million over the life of the project. MMC would fund both positions on an annual basis and coordinate with the employing agency to establish a collection agreement. In the future, if additional mines were developed in the Cabinet-Yaak Ecosystem, funding for both positions may be shared by other mining companies.

Duties of the law enforcement officer would be established by the KNF in counsel with the USFWS and FWP, and would be focused toward those enforcement activities needed to: (1) deter illegal killing of bears; (2) investigate reported/suspected bear deaths and help prosecute illegal actions; (3) minimize/eliminate mortality due to mistaken identity during black bear hunting seasons; (4) enforce applicable federal and state laws, regulations, and policy/guidelines regarding proper sanitation practices and elimination of bear attractants; and (5) enforce road access changes and help prosecute violations of road access changes and vandalism. Similarly, the duties of the information and education specialist would focus on: (1) education of school-age children regarding grizzly bear conservation; (2) development of educational materials and programs oriented toward mine employees; (3) implementation of informational/educational materials and programs oriented toward the general public and local community; and (4) integrating with the actions and programs of the Interagency Grizzly Bear Committee and its Subcommittees.

MMC would take additional measures to reduce mortality risk, including the following:

- Request the KNF restrict public motorized travel in upper Ramsey Creek
- Report road-killed animals to FWP as soon as road-killed animals were observed; FWP would either remove road-killed animals or direct MMC how to dispose of them
- Prohibit MMC employees from carrying firearms into permit areas
- Bear-proof all garbage containers
- Prohibit the feeding of bears and leaving of food or other bear attractants in the field

#### *2.4.6.3.3 Plan Management*

The KNF would prioritize and direct the land acquisition of the grizzly bear habitat preservation program. MMC would be responsible for carrying out the acquisition program, either directly or through contract with a third party. The KNF's duties in overseeing the mitigation plan would be as follows:

- Prioritize and direct the land acquisition and grizzly bear habitat preservation program
- Evaluate proposals and approve specific habitat enhancement projects for acquired lands
- Review MMC's annual progress reports on the status of the mitigation program
- Direct the Information and Education program, and determine if the program were needed after 5 years or if the program's funds should be redirected to other mitigation needs
- Evaluate the effectiveness of reclamation and determine if and when access changes on roads as part of the mitigation could be reversed, and the specific timing for releasing acquired lands

- The Forest Service, in counsel with the USFWS and the FWP, would be responsible for approval of each acquisition prior to purchase and approval of conservation easements

#### 2.4.6.4 Hard Rock Mining Impact Plan

MMC submitted to Lincoln County an update of the Hard Rock Mining Impact Plan that Lincoln County approved in 1991. The plan describes how the Montanore Project would affect local government services, facilities, costs, and revenues. The plan specifies the measures MMC would undertake to mitigate adverse fiscal impacts to local governments. MMC would prepay about $180,000 in taxes before construction to offset the net negative fiscal impact to the county budget during the first year. Lincoln County approved the updated plan in 2007. Because the Montanore Project as currently proposed would change employment projections, MMC submitted a petition for an amendment for consideration by the Hard Rock Mining Impact Board (Klepfer Mining Service 2008b). The Board approved the petition for amendment in 2008.

## 2.5 Alternative 3—Agency Mitigated Poorman Impoundment Alternative

### 2.5.1 Issues Addressed

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies to reduce or eliminate adverse environmental impacts. These measures are in addition to or instead of the mitigations proposed by MMC. Proposed modifications have been developed in response to the issues identified during the scoping process (ERO Resources Corp. 2006a).

In Alternative 3, four major mine facilities would be located in alternate locations. MMC would develop the Poorman Tailings Impoundment Site north of Poorman Creek for tailings disposal, use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed operating permit and disturbance areas at LAD Areas 1 and 2 to avoid important resources (Figure 22). The issues addressed by the modifications and mitigation measures are summarized in Table 13.

In Alternative 2, MMC's proposed tailings impoundment would be in Little Cherry Creek, a perennial stream, and the impoundment would require the permanent diversion of the upper watershed of Little Cherry Creek. Numerous wetlands and springs are in the Little Cherry Creek Impoundment Site. The lead agencies completed an alternatives analysis and evaluated numerous tailings impoundment sites. The sites considered for an impoundment are described in the section 2.13.2.4, *Tailings Impoundment*. The Poorman Impoundment Site was retained for detailed analysis because it would avoid the diversion of a perennial stream (Issue 2), and the loss of aquatic habitat (Issue 3), and would minimize wetland effects (Issue 7). Additional site comparisons between Alternatives 2 and 3 tailings facilities are presented in section 3.9.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison.*

Similarly, the lead agencies considered numerous sites for locating the plant site (see section 2.13.2.3, *Plant Site and Adits*). MMC's proposed plant site in the upper Ramsey Creek drainage would affect RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and Inventoried Roadless Areas (IRAs). An alternative plant site on a ridge separating Libby and Ramsey creeks was retained for

detailed analysis to address these issues. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would address (acid rock drainage and metal leaching (Issue 1). To avoid disturbance in the upper Ramsey Creek drainage, the adits in Alternative 3 would be in the upper Libby Creek drainage. This modification would address the same issues as the alternate plant site (Issues 3 and 5).

**Table 13. Response of Alternative 3 Modifications and Mitigations to Issues.**

| Key Issue | Mine Plan | Tailings Storage | Water Use and Manage-ment | Reclamation | Monitoring and Mitigation Plans |
|---|---|---|---|---|---|
| Issue 1-Acid Rock Drainage and Metal Leaching | ✓ | | ✓ | | ✓ |
| Issue 2-Water Quality and Quantity | ✓ | ✓ | ✓ | ✓ | ✓ |
| Issue 3-Aquatic Life | ✓ | ✓ | ✓ | | ✓ |
| Issue 4-Visual Resources | ✓ | ✓ | | ✓ | |
| Issue 5-Threatened or Endangered Species | ✓ | ✓ | | ✓ | ✓ |
| Issue 6-Wildlife | ✓ | ✓ | | ✓ | ✓ |
| Issue 7-Wetlands and Non-wetland Waters of the U.S. | ✓ | ✓ | ✓ | ✓ | ✓ |

MMC's proposed LAD Area 1 would disturb RHCAs (Issue 3), old growth (Issue 6) and IRAs; LAD Area 2 would disturb old growth. In Alternative 3, the lead agencies modified the permit areas and disturbance areas for the LAD Areas to address these issues (Figure 22).

In Alternative 2, MMC would discharge mine and adit wastewater from the Ramsey Adits at two LAD Areas. Wastewater would be treated at the Libby Adit Water Treatment Plant or a water treatment plant at the Ramsey Plant Site if necessary to meet discharge limitations. The lead agencies modified the proposed water management plan to address the uncertainties about quality of the mine and adit inflows, the effectiveness of LAD for primary treatment, quantity of water that the LAD Areas would be capable of receiving, and the effect on surface and ground water quality. In Alternative 3, MMC would use either the Libby Adit Water Treatment Plant and/or a water treatment plant at the Libby Plant Site to treat prior to discharge. These modifications would address Issue 2, water quality and quantity.

The modifications and proposed mitigations that comprise Alternative 3 are described in the following sections. All other aspects of MMC's mine proposal would remain as described in Alternative 2. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts. Many of the modifications and mitigations also would carry over into Alternative 4. MMC would submit a final Plan of Operations after final design, including all monitoring and mitigation plans, to the

KNF for approval. MMC would submit a final application for a modification of Operating Permit #00150, including all monitoring and mitigation plans, to the DEQ for approval.

## 2.5.2 Evaluation Phase

### 2.5.2.1 Objectives

As described in Chapter 1, MMI acquired the DEQ Operating Permit #00150, private land at the Libby Adit Site and in the Little Cherry Creek drainage, and water rights previously held by Noranda (now Montanore Minerals Corporation). In 2006, MMI proposed and received approval from the DEQ for two minor revisions to DEQ Operating Permit #00150. The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that Noranda began in 1989. A description of DEQ Operating Permit #00150 is provided in Chapter 1. The KNF determined the activities associated with the Libby Adit evaluation drilling were a new Plan of Operations under the Federal Locatable Minerals Regulations (36 CFR 228 Subpart A), and MMC needed KNF approval prior to dewatering and continuing excavation, drilling, and development work at the Libby Adit. Under the authority of Minor Revision 06-002 of the DEQ operating permit, MMC has installed a water treatment plant and is allowed to treat free flowing water from the adit.

In 2006, the KNF initiated a NEPA analysis that included public scoping for the proposed road use and evaluation drilling at the Libby Adit Site. In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider this activity as the initial phase for the overall Montanore Project EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4. The objectives of the evaluation program would be to:

- Expand the known higher grade zones of the deposit
- Develop additional information about the deposit to support a bankable feasibility study
- Assess and define the mineralized zone that extends beyond the current resource boundary
- Provide additional data for geotechnical, hydrological, and other information required to complete a final, bankable feasibility study

### 2.5.2.2 Proposed Activities

The evaluation drilling program is designed to delineate the first 5 years of planned production. An estimated 35,000 feet of primary drilling and 12,800 feet of infill drilling are planned. The drill core would be used to support resource modeling, mine planning, metallurgical testing, preliminary hydrology assessment, and rock mechanic studies for the full Montanore Project. If adit closure and site reclamation were necessary after completion of the evaluation drilling program, MMC would install a concrete-reinforced hydraulic plug in bedrock, reconstruct the original adit plug, remove all surface facilities, and regrade and revegetate the disturbed areas. Additional information about the evaluation drilling program and site operations and reclamation can be found in MMC's *Notification to Resume Suspended Exploration and Drilling Activities for the Montanore Project, Revision 2* (MMC 2006), on file with the lead agencies.

The Libby Adit would be rehabilitated and the drift extended 3,300 feet. An additional 7,100 feet including the 16 drill stations would be developed under the currently defined ore zones. An estimated 256,000 tons (174,000 cubic yards) of waste rock would be generated and stored on private land at the Libby Adit site. The waste rock storage areas would be lined to collect runoff from the area and seepage through the waste rock. A sump would be located at the toe of the pile where runoff and seepage would be collected and pumped up to the water treatment plant. MMC would implement two monitoring programs to assess water quality of runoff and seepage from waste rock. These two programs would be a waste rock test pad and waste rock column tests. The information collected by these tests would assist the agencies in determining if the full facility would be lined as proposed in this plan. MMC would submit the information and a request to modify the plan if lining was not needed to meet effluent limits. MMC would install a small lined test an area near the top of the waste rock storage area near the area. Initial development rock from the Libby Adit would be placed onto a lined area. A sump would be constructed that would collect any runoff and seepage from the waste rock and pump it back through the water treatment plant and the treated water would be discharged in one of the three permitted MPDES outfalls. Runoff and seepage from the waste rock pile would be analyzed for metals and nitrate, consistent with the MPDES permit monitoring requirements. In the waste rock column tests, MMC would collect samples at the face prior to material being removed for disposal on the lined facility. The objective of the nitrate test would be to determine the amount of residual nitrate/ammonia that remains in the waste rock; metal analyses also could be completed.

The Libby Adit would be dewatered and water would be treated prior to discharging to one of three permitted outfalls. Water quality discharge parameters have been set in MMC's MPDES permit MT-0030279. This permit regulates wastewater discharges from the Libby Adit, and sets effluent discharge quality for both surface and ground water. Treated waters would be discharged to a percolation pond located at the Libby Adit Site. Some of the downstream surface water quality monitoring stations used in assessing effects of the discharges would be located on the National Forest System lands.

The underground evaluation program is anticipated to last 18 to 24 months. MMC would employ 30 to 35 people at the Libby Site and would work two 10-hour shifts 7 days per week. The hours of operation would fluctuate based on daily requirements, but would operate 7 days per week.

Supporting surface facilities are located on private lands at the Libby Adit Site and include an office, shop, generators, waste rock stockpile, and other ancillary facilities. All of the proposed underground work, except for the portal area, is within the KNF. Power to the Libby Adit would be supplied by up to four 850-kw propane generators. The generators would be supplied by a third party contractor, which would provide the generators and be responsible for holding an air quality permit for them.

MMC would use Libby Creek Road, NFS road #231, and Upper Libby Creek Road (NFS road #2316) as the primary year around access to the surface facilities at the Libby Adit Site. These roads would be snow plowed to allow access during winter.

### 2.5.2.3 Reclamation

MMC may retain the dewatering pumps and operation of the treatment plant beyond the evaluation program. Dewatering and water treatment would continue until a bedrock portal plug was installed. As part of permanent closure and site reclamation, a portal plug would be installed in bedrock near the bedrock/colluvial contact point 600 feet from the portal opening. To ensure

long-term stability, waste material would be backfilled into the adit from the bedrock plug out to the surface opening where another plug would be re-installed as originally designed. One this surface plug is installed excavated material would be placed back over the portal plug and general opening and regraded to match the surrounding topography. Other surface features, such as the waste rock stockpiles and the percolation pond would be regraded. All surface facilities, buildings, power supply and equipment would be removed. The stockpiled 18 inches of soil would be placed over the regraded and scarified areas. The disturbed sites would be reseeded.

#### 2.5.2.4 Agency Mitigation

The KNF developed specific design features and mitigation for the evaluation phase of the project. These measures are common to both Alternative 3 and Alternative 4 and would be implemented prior to dewatering the Libby Adit and beginning any underground activities. The fisheries mitigation measures for the evaluation phase are described in section 2.5.7.2.1, *Access Road Use*. Mitigation for wildlife is incorporated into the overall wildlife mitigation plan (see section 2.5.7.3.1, *Grizzly Bear*); italicized item listed in section 2.5.7.3.1, *Grizzly Bear* would be implemented prior to the evaluation program. The design features and mitigation measures are for the evaluation phase of the Libby Adit would remain in place for the life of the Montanore Project. MMC would implement the all other design features and mitigation for the full Montanore Project prior to beginning the construction phase of the mine. The hydrology monitoring during the evaluation phase is described in Appendix C.

### 2.5.3 Construction Phase

#### 2.5.3.1 Permit and Disturbance Areas

All operating permit disturbance area boundaries would be marked in the field with fenceposts and signed to limit potential disturbance outside permitted disturbance areas. The operating permit area would total 2,606 acres and the disturbance area would total 2,011 acres (Table 14).

In Alternatives 3 and 4, MMC would complete before final design and any ground-disturbing activities an intensive cultural resources survey and a jurisdictional wetland delineation on all areas proposed for disturbance for any areas where such surveys have not been completed and that would be disturbed by the alternative. Similarly, MMC would complete a survey for threatened, endangered, and Forest and state sensitive plant species on National Forest System lands for any areas where such surveys have not been completed and that would be disturbed by the alternative. The surveys would be submitted to the agencies for review and comment. If adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities.

#### 2.5.3.2 Vegetation Clearing and Soil Salvage and Handling Plan

During final design, MMC would submit a final Soil Salvage and Handling Plan to the lead agencies for approval. The plan would include means to ensure that the necessary amount of suitable soil was salvaged in disturbed areas, that soils would be stockpiled and redistributed properly, and that losses from handling and erosion on stockpiles and in reclaimed areas would be minimized. Also, the timing and sequencing of stockpile use (for respreading) would be detailed to ensure that visual impacts would be mitigated, and that direct-haul methods would be maximized.

**Table 14. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 3.**

| Facility | Disturbance Area† (acres) | Permit Area (acres) |
|---|---|---|
| Existing Libby Adit | 22 | 219 |
| Upper Libby Adit | 1 | 1 |
| Rock Lake Ventilation Adit | 1 | 1 |
| Libby Plant Site and Adits | 110 | 172 |
| Poorman Tailings Impoundment | 1,359 | 1,585 |
| Poorman Tailings Impoundment and Seepage Collection Pond | 608 | |
| Borrow areas outside impoundment footprint | 92 | |
| Soil stockpiles | 48 | |
| Other potential disturbance (roads, storage areas, ditches, etc.) | 617 | |
| LAD Area 1 | 260 | 277 |
| LAD Area 2 | 123 | 196 |
| Access Roads† | | |
| Bear Creek Road (NFS road #278 from U.S. 2 to Tailings Impoundment) | 90 | 0 |
| Tailings Impoundment permit area to LAD Areas 1 and 2 (NFS roads 2317 and #4781, existing NFS road #278, and new NFS road #278) | 19 | 74 |
| LAD Areas to Libby Plant Site (NFS road #4781 and #6210) | 17 | 70 |
| Libby Plant Site to Libby Adit Site and Upper Libby Adit Site (NFS roads #6210 and #2316) | 9 | 11 |
| Total | 2,011 | 2,606 |

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.

#### *2.5.3.2.1 Vegetation Removal and Disposition*

As part of final design, MMC would prepare a Vegetation Removal and Disposition Plan for the agencies' approval. The plan would evaluate the potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during mine life. It also would address vegetation removal along the transmission line (see transmission line Alternatives C, D, and E), with the goal of minimizing tree and other vegetation clearing.

Because of observed metal leaching problems and low pH seepage from soil stockpiles containing large amounts of coniferous vegetation at other mine sites in Montana, the majority of coniferous forest debris would be removed before soil removal. Merchantable timber would be measured, purchased from the KNF, and then cleared before soil removal. Non-merchantable trees, coniferous forest debris, and slash from vegetation clearing in the mine disturbance areas and along the transmission line would be managed in accordance with Montana law regarding reduction of slash (76-13-407, MCA) and, on National Forest System lands, KNF objectives regarding fuels reduction. Excess slash would be removed or burned in all timber clearing areas

and within 0.5 mile of any residence. Slash management on Plum Creek and other private lands not owned by MMC would be in accordance with Montana law and the landowner/MMC easement agreement. Non-merchantable trees and coniferous forest debris would be removed using a brush blade or excavator to minimize soil accumulation. MMC would comply with open burning requirements. Where possible, slash of non-coniferous forest debris or dead coniferous forest snags would be salvaged and chipped to be sold, used as mulch, or used as an additive to stored soil. Large woody debris would be used in instream structures proposed in the fisheries mitigation plan. All mulching materials would be certified weed-seed free.

#### *2.5.3.2.2 Soil Salvage*

MMC would salvage soils in all disturbed areas, with the exception of slopes exceeding 50 percent and soil stockpiles. Suitability of soils proposed for reclamation was determined from physical and chemical data collected during the baseline soils survey. Soils would be salvaged in two lifts in the tailings impoundment site, borrow areas, Libby Plant Site, and LAD Areas. The first lift would include the relatively organic-rich surface layers (topsoil), and the second lift would include the subsoil immediately below the topsoil to a depth based on need and suitability. At road disturbances, soils would be salvaged in one lift. Soils with more than 50 percent rock fragment generally would not be salvaged. Soils with rock fragment contents up to 60 percent by volume would be salvaged in some areas to provide erosion protection on the tailings impoundment embankments.

#### *2.5.3.2.3 Soil Stockpiles*

Most soils would be stockpiled as close as possible to redistribution sites. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps, where possible. The two-lift salvage program would segregate according to soil erodibility (*i.e.*, rock fragment content) and first lift versus second lift. For example, glaciolacustrine soils, having the greatest erodibility and few rock fragments, would be stockpiled separately from first lift materials that contain a large amount of rock fragments, and second-lift glaciolacustrine clay-rich soils would be stockpiled separately from other second-lift soils. The stockpiles would be signed, based on the use in the post-mining landscape.

In Alternative 2, MMC proposes to stabilize soil stockpiles when they reach their design capacity and seed during the first appropriate season following stockpiling. In Alternatives 3 and 4, MMC would incrementally stabilize soil stockpiles (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity in the surface. Seeding should be done as soon after disturbance as possible rather than waiting until the next appropriate season. Immediate seeding of road cuts-and-fills would reduce erosion on Forest Service roads regardless of planting time. To the extent possible, MMC would stockpile soils in clearings or recent timber harvest areas that were immediately adjacent to new roads, which would be operational for mine life, rather than stockpiling along the entire road corridor.

Soil stockpiles would have organic matter and fertilizer added to help retain soil quality and promote successful revegetation. Noxious weeds on stockpiles would be controlled throughout the stockpile life, and sprayed before soil redistribution.

MMC would report soil stockpile volumes and disturbance acres in each annual report to the lead agencies. MMC would prepare an annual soil reconciliation report to document that the soils in stockpiles were sufficient to reclaim the current disturbed acres. If a shortfall existed, MMC would submit a plan to make up for the soil shortfall in the following year.

#### *2.5.3.2.4 Soil Replacement and Handling*

MMC would replace soils in all disturbed areas, with the exception of soil stockpiles and cut slopes in consolidated material. In Alternative 2, MMC proposed to redistribute 24 inches of soil on the embankment of the tailings impoundment in two lifts: 15 inches of rocky subsoil on the bottom followed by 9 inches of topsoil on the top. Replaced soils depths on other disturbed areas would be 18 inches including the top of the tailings impoundment. Other reclaimed sites in Montana have shown that 24 inches of replaced soil provides sufficient rooting depth (Plantenberg, pers. comm. 2006). In Alternatives 3 and 4, where redistributed soils cover non-native material, the replaced soil depth would average 24 inches using two lifts, including over the entire tailings impoundment. If any waste rock stockpiles remained at the end of mining, and depending upon acid generation or near neutral metal leaching potential and size and amount of rock fragments, 24 inches of replaced soil in two lifts may be needed to provide sufficient rooting depth. Soils replacement depths at other disturbances where soil is to be replaced, except road disturbances, would be 18 inches and would be applied in two lifts. If MMC demonstrated through test plots that site-specific soils would provide sufficient root zone and revegetation success at thinner applications, the thickness could be reduced at the lead agencies' concurrence.

Soils in the impoundment area would be replaced based on soil erodibility and slope steepness. For example, the least erodible colluvial/glacial soils having the greatest rock fragment content for both first lift and second lift soils, would be used on the impoundment face to minimize erosion potential. The soils with the greatest erodibility, primarily glaciolacustrine soils, would be used on slopes less than 8 percent, such as the relatively flat tailings impoundment surface. Soil salvage and redistribution would occur throughout the life of the mine operation. Soils should be handled and worked at the minimal moisture content to reduce the risk of compaction and tire rutting.

Disturbed areas, such as parking areas, roads, adit portal areas, top of the tailings impoundment, and building sites would be ripped to 18 inches deep with dozer ripping teeth prior to soil replacement to reduce any root zone barriers due to compaction and to facilitate storm water infiltration after reclamation. Any disturbed area to be seeded would be scarified to a depth of 6 to 12 inches prior to seeding for best seed establishment. All disturbed areas would be seeded, fertilized, and mulched as necessary. Where soil fertility may be low and tilth poor, organic matter (weed-free agencies-approved wood-based compost) would be incorporated into respread soils before planting. All permanent cut and fill slopes on roads would be seeded, fertilized, and stabilized with hydromulch, netting, or by other methods.

Mycorrhizae, which are structures in the soil important in maximizing plant establishment and productivity, especially for woody plants, are eliminated in soil stored for prolonged periods. In reclaimed areas where trees would be planted, an agencies-approved wood-based compost would be incorporated into the upper 6 inches of respread soil that had been stored for prolonged periods to promote the rebuilding of mycorrhizae in the soil (Plantenberg, pers. comm. 2006), and/or inoculated tree-planting stock with the appropriate mycorrhizal fungi would be used, or mycorrhizal fungi would be incorporated into the soil as pellets during seeding. Additional nitrogen fertilizer may be needed to compensate for wood-based mulch.

#### *2.5.3.2.5 Direct Haul and Temporary Storage of Soil*

Direct haul soil salvage and replacement would be required for use whenever, and as much as possible, to enhance revegetation success of native unseeded species (Prodgers and Keck 1996 *In*

USDA Forest Services and DEQ 2001). Direct haul would be done primarily at the tailings impoundment.

Areas such as road cut-and-fill slopes, transmission line structure locations and access roads, and other disturbances that would remain post-mine should be reclaimed as soon as final grades were achieved with direct haul soil or soil that had been stockpiled for less than 1 year. This would increase the chances of direct transplantation and propagation of many of the local ecotypes on the reclaimed surface (Prodgers and Keck 1996 *In* USDA Forest Services and DEQ 2001).

### 2.5.3.3 Libby Plant Site and Adits

Pre-production development would be similar to Alternative 2, but the Libby Plant Site would be located on a ridge separating Libby and Ramsey creeks (Figure 25). The same facilities proposed for the Ramsey Plant Site (Figure 5) would be built at the Libby Plant Site. Access to the plant site would be via NFS roads #2316 and #6210. A permanent bridge would be constructed across Ramsey Creek to provide access to NFS road #6210 from the Ramsey Creek Road. The bridge would be built in compliance with the INFS standards and guidelines (USDA Forest Service 1995). Soil from the Libby Plant Site would be salvaged and stored in a stockpile in a timber harvest area along NFS road #14403.

In Alternative 3, four adits would be required for the project, similar to Alternative 2. The two Ramsey Adits would be relocated into the Libby Creek drainage area (Figure 25). The ventilation adit located near Rock Lake proposed in Alternative 2 would remain the same (Figure 4) and the existing Libby Adit would be enlarged. The relocation of the Ramsey adits would not significantly alter the targeted access points into the deposit (crusher area, etc.) as proposed in Alternative 2.

The existing Libby Adit would be enlarged to about 30 feet wide by 30 feet high. An additional adit would be constructed on MMC's private land near the existing Libby portal and would be 17,000 to 18,000 feet long and decline to the ore body at 5 percent grade, depending on the portal location selected. These two adits would serve the same function as the two Ramsey Adits with one adit containing the underground conveyor and the other used for personnel access and material delivery into the mine. The exact location of the second adit on private land has not been determined. Two options for this adit portal have been identified.

A third adit (Upper Libby Adit), upstream of the Libby Adit Site, would provide ventilation and emergency access. This adit would be 13,700 feet long, and decline to the ore body at about a 7 percent grade. To the extent feasible, the Upper Libby Adit would be constructed from underground, and waste rock hauled out of the Libby Adit Site, and not the Upper Libby Adit site.

Ore would be conveyed via an above-ground covered conveyor from the Libby Adit Site 6,000 and 7,500 feet to the covered coarse ore stockpile at the Libby Plant Site. The conveyor would parallel NFS roads #2316 and #6210. The agencies identified two options for the conveyor: one would be about 10 feet wide and 10 feet high, and the other would be lower (8 feet), but wider (16 feet) (Figure 24). The conveyor would be designed to minimize contact with precipitation and loss of ore. A "wraparound" conveyor would achieve these objectives and would eliminate the need for a transfer point at the intersection of NFS roads #2316 and #6210. A completely enclosed conveyor may also be used. Any spillage would be promptly cleaned up to avoid contact with precipitation.

Geotechnical investigations of the Libby Plant Site have not been completed. If the depth to bedrock at the site were similar to the Libby Adit Site or LAD Area 1, preliminary evaluation indicates the Libby Plant Site could be built out of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Consequently, the fill slopes at the plant site would not be subject to the ELGs, and a MPDES outfall would not be needed at the site.

Electrical power would be the same as Alternative 2. Electrical power during the initial preproduction phase would be supplied by two 1,250-kW diesel generators located at the Libby Adit, same as Alternative 2. A buried 34.5-kV transmission line along Bear Creek Road and the Libby Plant Access Road may be installed to replace the generators prior to the installation of the main transmission line. If the buried 34.5-kV line were installed, the generators would be used as standby power during construction operations. To provide power to the Libby Adit activities, a temporary substation would be installed near the intersection of NFS road #6210 and the Libby Plant Site Access Road (Figure 7). If constructed, the 34.5-kV line along Bear Creek Road and the Libby Plant Access Road would connect to this substation. Power would be distributed from the temporary substation to the Libby Adit Site and Libby Plant Site.

#### 2.5.3.4 Waste Rock Management

Waste rock developed extending the Upper Libby Adit and the new Libby Adit would be hauled to a waste rock stockpile within the Poorman Tailings Impoundment footprint, the location of which would be determined during final design. As part of the Libby Adit evaluation program, MMC would complete a test of water that infiltrated and ran off of the waste rock stockpile at the Libby Adit Site (see section 2.5.2, *Evaluation Phase*). This testing was a condition in DEQ's approval of Minor Revision 06-002. If monitoring results or other waste rock testing indicated water treatment would not be necessary, a retention pond sized to store a 10-year/24-hour storm would retain any runoff. The Seepage Collection Pond or the Starter Dam may serve this purpose if they were constructed before waste rock generation. If monitoring results or other waste rock testing indicate treatment would be necessary, the waste rock stockpile would be lined with clay or a geomembrane to achieve a permeability of less than or equal to 10-6 cm/sec. MMC would provide a stability analysis if the area were lined. If treatment were necessary, collected water would be pumped to the water treatment facility at the Libby Adit.

A waste rock sampling plan is described in MMC's waste rock management plan (Geomatrix 2007b). In addition to the management, sampling, and analysis described in the plan, MMC in Alternative 3 would:

- Segregate potentially acid-generating materials or materials with the potential to leach metals at a near neutral pH from portions of the lower Revett and Prichard Formations for additional kinetic and metal mobility testing and provide for selective handling as indicated by test results
- Isolate and place such materials under sufficient cover to minimize direct exposure to the atmosphere and precipitation until geochemical test work was complete
- Conduct sampling to represent the mineralized alteration haloes within the lower Revett, and the portions of the Burke and Wallace formations to supplement limited baseline data (Alteration haloes are zones of changed mineralogy that occur around the ore deposit, containing chalcopyrite-calcite, pyrite-calcite, and galena-calcite mineralization)

- Conduct operational verification sampling within the Prichard Formation during development of the new adits
- Use static acid-base potential analyses with kinetic test data to identify operationally achievable handling criteria and to guide waste management
- In addition to analysis for acid-base potential, conduct analyses to assess the magnitude of trace metal release for waste rock at a near neutral pH
- Complete additional characterization of trace metal release potential for tailings once more representative bulk samples were obtained during mine development work
- Conduct additional sampling and analysis of barren zone to evaluate its potential to generate acid and or release elevated lead concentrations

#### 2.5.3.5 Tailings Management

The agencies developed the Poorman Impoundment Site as an alternative because it would avoid the diversion of Little Cherry Creek, reduce the loss of aquatic habitat, and would minimize wetland effects. The Poorman Impoundment Site would not provide sufficient capacity for 120 million tons of tailings without a substantial increase in the starter dam crest elevation if tailings were deposited at a density proposed in Alternative 2. The tailings thickener requirements to achieve higher tailings slurry density (and hence higher average in-place tailings density) are uncertain without additional testing of simulated tailings materials. Such testing would be completed during the Libby Adit evaluation program. These issues and the development of the Poorman Impoundment Site for tailings disposal are discussed in the following sections. Additional site comparisons between Alternatives 2 and 3 tailings facilities are presented in section 3.9.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison.*

##### *2.5.3.5.1 Tailings Deposition Methods*

Tailings management depends on the amount of solution or water mixed into or removed from the tailings, *i.e.*, the slurry density, for purposes of deposition. The most appropriate method of tailings management for a given project depends on several factors including tailings characteristics, tailings disposal site conditions, and project-specific factors such as production rates, environmental constraints such as shallow depth to water table and unstable foundation conditions, and distance from the ore processing mill to the tailings disposal site. Tailings disposal methods available under current technologies are listed below along with a typical range of slurry densities associated with each method. Similar values are presented in MMC's operating permit application (Klohn Crippen 2005). Slurry density can vary between methods depending on the physical and geotechnical characteristics of site-specific tailings. Percent slurry density is the ratio of the dry weight of solids in the slurry to the total slurry weight (dry solids weight plus the water weight) for the total tailings stream or any unit measurement of the tailings stream.

- **Slurry Tailings Deposition** – This traditional method of tailings disposal is used at the Troy Mine and proposed by MMC in Alternative 2. Slurry tailings deposition also would be used in Alternative 4. Slurry density is generally 55 percent or less and the slurry is characteristic of a thick or heavy fluid with respect to gravity flow and pumping.

- **Thickened Tailings Deposition** – Slurry density is generally between 55 percent and 65 percent and the slurry is characteristic of a thick batter mix with respect to flow and pumping; deposition is similar to slurry tailings but the solids tend to settle more quickly and form a slightly steeper slope.
- **Paste Tailings Deposition** – Slurry density is between 65 percent and 80 percent and the slurry is characteristic of a thick molten material or gooey "toothpaste" that drains off excess solution upon deposition and creates a steeper tailings slope. Paste tailings with a slurry density in the lower part of this range are sometimes referred to as high-density or highly thickened tailings slurry. Transport to the point of deposition requires special pumping considerations such as the use of positive displacement pumps (similar in concept to concrete pumps). This is the approved method of tailings deposition for the Rock Creek Project.
- **Dewatered Tailings Deposition** – Slurry density is between 80 percent and 83 percent and the slurry is characteristic of a high-slump concrete mix and readily drains off excess solution upon deposition to resemble a very wet soil-like material within a short period of time. Dewatered tailings can be stacked at steeper slopes than paste tailings at deposition.
- **Filter Cake or Dry Deposition** – Slurry density is at or greater than 83 percent and material is handled and deposited as a moist to wet soil material. The moisture content of the tailings at deposition is less than 100 percent saturation.

Deposition of tailings slurries at thicker densities can offer several advantages over slurry tailings at 55 percent or less. The primary advantage is that water recovery increases as part of the process in preparing the thicker slurry densities, thus reducing make-up water requirements and the amount of excess water stored in the impoundment. In addition, high-density tailings and dewatered/filter tailings are generally more dense at deposition and consolidate to a higher density more rapidly than slurry tailings and can be used to create a more stable tailings embankment. As a result of the lower water content and increased density, the shear strength generally increases over slurry tailings. Tailings surface slopes are, therefore, generally steeper and more stable than the slurry tailings. In some cases, this allows for the tailings to be deposited from up gradient slopes at an elevation above the level surface of the tailings. Depending upon the native ground slope, and the impoundment geometry, high-density to dewatered and filtered tailings can be discharged from a higher elevation to create a slope of tailings above the normal impoundment level. Such deposition along with increased density in the placed tailings can be used to develop a deposition plan to reduce the required impoundment capacity, lower the dam crest, and possibly reduce the impoundment footprint.

The Poorman Impoundment Site is amenable to high-density tailings deposition from the upstream perimeter slopes, whereas the Little Cherry Creek site has limited capacity for high-density tailings deposition from slopes upstream of the impoundment. In Alternative 2, the drainage area above the diversion dam on Little Cherry Creek would have to be used for high-density tailings deposition to be beneficial in increasing impoundment storage capacity. The Poorman Impoundment Site could be used for deposition of slurry tailings at a 55 percent slurry density. To hold 120 million tons, the main dam would be 20 feet higher and would require considerably more borrow material to construct for slurry tailings deposition than for high-density tailings deposition. Therefore, high-density tailings deposition is used in the Alternative 3 dam and impoundment layout described in the following paragraphs.

#### *2.5.3.5.2 Final Design Process*

The tailings facility design would be based on additional site information obtained during the design process, which would include a preliminary design phase and a final design phase. Site information would be collected under exploration programs for each of the two design phases. A preliminary site exploration program would be completed to confirm the geotechnical suitability of the site should Alternative 3 be selected as the preferred site. The field exploration program would include a site reconnaissance and a drilling and sampling program to evaluate:

- Site geology and foundation conditions
- Ground water conditions and water quality
- Borrow material availability
- Geotechnical characteristics of foundation and borrow materials

Based on these data, a preliminary design of the Alternative 3 site would be completed to confirm the site layout and design/operation feasibility. The second field exploration program would be completed to collect data and material samples necessary for the final design of the facility. In Alternatives 3 and 4, MMC would, during final design:

- Incorporate guidelines from the Idaho Administrative Code Safety of Dam Rules and the California Department of Water Resources, Division of Safety of Dams for seismic stability as appropriate
- Use more recent attenuation relationships that are based on instrumental records of attenuation collected in the United States and internationally (Spudich *et al.* 1999 and Boore *et al.* 1997)
- Complete circular failure plane assessments through the near-dam tailings and dam section and through the dam crest and slope
- Submit final design to the agencies for approval
- Fund a technical review of the final design by a technical review panel established by the lead agencies

Technical review of the final design would be made by a technical review panel established by the lead agencies. The review would encompass the technical aspects of design including the short- and long-term stability of the tailings storage facility. If supplemental rock and tailings characterization data and geochemical testing showed a potential for acid generation not presently anticipated, the review also would include an evaluation of the seepage collection system to ensure that no seepage would reach surface water. The technical review panel would assist in the development of the QA/QC protocols. The panel would ensure that any environmental impacts associated with final design remained within the scope of those impacts identified in the Final EIS. If the final design generated additional impacts and they could not be mitigated, additional MEPA/NEPA documentation may be required. The lead agencies would review and approve the final design prior to construction.

#### *2.5.3.5.3 Poorman Tailings Impoundment Site Location*

The conceptual Poorman Tailings Impoundment Site would be located between Little Cherry and Poorman creeks in an ephemeral watershed tributary to Libby Creek could be developed to hold 120 million tons of tailings and support facilities (Figure 26). The site would be entirely on

National Forest System lands. Private property not owned by MMC would be located 300 feet east of the southern two-thirds of the tailings dam alignment. The Poorman site is in Sections 24 and 25, Township 28 North, Range 31 West. Tailings would be transported to the site from a mill as a slurry, the same as proposed by MMC in Alternative 2. At the site, the tailings would be sent to a thickener plant and deposited in the impoundment as high-density tailings.

The Poorman Tailings Impoundment Site is a broad, east-facing slope about 0.25 mile west of Libby Creek. Like the Little Cherry Creek site, ground water beneath the site exhibits artesian pressures in the base of the slopes above Libby Creek (Morrison-Knudsen Engineers, Inc. 1989a). The geology and near surface soils of the site are similar to the materials found in the Little Cherry Creek tailings site (Alternative 2) except that soft weak clays do not appear to be present in the soil strata (Morrison-Knudsen Engineers, Inc. 1989a).

#### *2.5.3.5.4 General Proposed Facilities*

In Alternative 3, the cyclone overflow (the fine tailings fraction after the sand is removed to build the sand dam), would be deposited as high-density tailings slurry with an average slurry density of 70 percent. The ability to achieve these densities is discussed in section 3.9.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison*. The agencies assumed thickening to an 80 percent density for the Rock Creek Project, which is proposing the mine in the same formation as the Montanore Project (see section 3.8.3.1.2, *Alternative 2 – MMC's Proposed Mine* for a discussion of the geologic similarities between the Rock Creek and Montanore deposits). At a 70 percent slurry density, the average settled density of the tailings over the life of the project is estimated to be 85 pounds per cubic foot (pcf). As excess water drains from the fine tailings mass and the mass consolidates under long-term conditions, the average mass density could exceed 90 pcf. The time frame for such consolidation and the final average tailings density would depend upon the characteristics of the tailings and deposition patterns around the impoundment. The tailings slope is estimated to be 5 percent and the tailings shear strength sufficient to remain stable. Laboratory tests would be run to confirm the slurry densification and shear strength characteristics, and seepage-induced consolidated tests would be performed on representative tailings samples to determine the appropriate slurry density, slope at deposition, and expected consolidation behavior of the tailings.

Site development would include site stripping and foundation preparations followed by construction of a Starter Dam built from waste rock and borrow materials (as in Alternative 2), a Rock Toe Berm under the toe of the Main Dam for stability, a drainage system within the impoundment area (as in Alternative 2), a Seepage Collection Pond and associated pumpback well system (as in Alternative 2), a Saddle Dam on the north side of the impoundment, a tailings thickening plant, a waste rock stockpile, topsoil and subsoil stockpile areas, and relocation of NFS road #278.

The tailings dam would consist of three sections, the Starter Dam along the upstream toe of the Main Dam section, a Rock Toe Berm to buttress/support the sand dam along the Main Dam section, and a Main Dam section consisting of the sand fraction cycloned from the tailings (Figure 26 and Figure 27). The dam would have a final crest length of 10,300 feet at an elevation of 3,664 feet. The dam would have a vertical height of 230 feet above the Rock Toe Berm and 360 feet including the Rock Toe Berm. The dam layout is designed to maximize the height of the dam section based on estimated quantities available from the cyclone operations and to minimize fill requirements to balance the fill volume required for the total dam. Based on initial evaluation, the layout is considered feasible, but would be revised in final design, if possible, to reduce total fill quantities.

An impoundment with a Main Dam crest of 3,664 feet would contain almost all of the thickened tailings. With an average in-place density of 85 pcf at completion of tailings deposition (91.4 million tons), about 1 foot of additional dam crest would be required for complete storage of the tailings at a level surface. Assuming a level tailings surface, the impoundment capacity at the estimated dam crest elevation in the final years of operation would not allow for water storage within the impoundment area nor account for lost capacity due to the slope of the tailings surface. The dam maximum crest would be set at about 3,664 feet based on the Starter Dam and Rock Toe Berm layouts and the volume of cyclone sand available for construction of the Main Dam. Perimeter tailings deposition from an elevated position along the back slope of the impoundment would be required to store all of the tailings and allow for water storage within the impoundment during the final years of operation as discussed in subsequent sections. The cross-section shown in Figure 27 shows the estimated height and slope of the tailings surface with deposition from the perimeter slopes.

#### Foundation Preparations

Foundation preparations would be as described in Alternative 2. Based on limited field data, no unsuitable foundation conditions relative to dam stability are anticipated in the Poorman Site. In the event unsuitable materials were identified in subsequent design studies, or otherwise encountered in the site, such material would be excavated and stored in a stockpile. The material would be used for cover material in closure of the tailings facility or backfilled into borrow areas.

#### Rock Toe Berm

A Rock Toe Berm would be constructed as a compacted rock fill structure in the toe area of the Main Dam. The Rock Toe Berm is designed to reduce the volume of cyclone sand required to construct the dam to the design height, and limit the height of the sand dam to allow a steeper downstream face to reduce the required sand volume. The Rock Toe Berm would be a free draining structure to prevent build up of a water surface in the toe of the Main Dam. The Rock Toe Berm would have a 30-foot wide crest at an elevation of 3,440 feet with a 2.5H:1V downstream slope and a 3H:1V upstream slope. The upstream face of the Rock Toe Berm would be of screened material to create a surface that is filter compatible with the tailings sand to prevent the tailings sand from migrating into the Rock Toe Berm. The crest length is 4,400 feet and the vertical height at the maximum section is 140 feet. The total estimated volume of the Rock Toe Berm is 2.7 million cubic yards. About 1.2 to 1.5 million cubic yards of waste rock would be available from initial mine development and early mine operations. The balance of material would be obtained from either a rock borrow quarry developed in the upper elevations of the site where soil cover is minimal (Figure 26) or from suitable sand and gravel lenses noted in the glacial deposits located at the site (Morrison-Knudsen Engineers, Inc. 1989a).

#### Starter and Saddle Dams

The Starter Dam would be a compacted earthfill embankment with a 70-foot wide crest at an elevation of 3,480 feet (Figure 26). Upstream and downstream slopes would be 2.5H:1V. The wide crest was selected to reduce sand requirements in the Main Dam. The estimated crest length is 6,000 feet and the maximum section about 100 feet high. The Starter Dam would be constructed with borrow material excavated from surface and near surface glacial deposits within or adjacent to the impoundment (Figure 26). The conceptual layout volume is estimated to be 1.7 million cubic yards. The fill would be placed in maximum uncompacted lifts of 1 foot or less and compacted with suitable equipment. All boulders larger than 8 inches diameter would be removed from the fill. A Saddle Dam of similar construction would be required in the north perimeter of

the impoundment area. The Saddle Dam volume is estimated to be 730,000 cubic yards. The estimated volume of available borrow within the impoundment area is in excess of 5 million cubic yards. During Starter Dam construction, a temporary water reclaim/storage pond would be constructed upstream from the Starter Dam to hold water until the Starter Dam was complete.

After the Starter and Saddle Dams were constructed, the impoundment footprint would be prepared for tailings deposition after operations began. Any soft, unsuitable materials would be either excavated and transported as backfill for the borrow areas, or filled with suitable material, such as general fill from borrow areas. All wetland soils would be excavated and used at wetland mitigation sites (see section 2.5.7.1, *Wetland Mitigation*). Final design for management of these types of materials would be submitted to the agencies for approval. A high-density, polyethylene (HDPE) geomembrane liner would be placed beneath a portion of the tailings impoundment and keyed into the low permeability zone of the dam (Figure 26 and Figure 27).

**Borrow Materials**

The primary source for borrow materials for the starter and Saddle Dams would be local borrow materials from within the impoundment footprint (Figure 26). The borrow source for the Rock Toe Berm would be waste rock from the mine stockpiled at the site supplemented by local borrow within or adjacent to the impoundment area. Borrow for the Rock Toe Berm from within the impoundment site would consist of sands and gravels obtained for lenses in the underlying glacial alluvial material or bedrock obtained from a quarry site that could possibly be developed in the higher elevations where soil cover appears to be shallow compared to most of the impoundment area. Ideally, the quarry would be below the proposed relocated access road and within the upper tailings area.

Drain materials would be obtained from on-site crushing and screening of suitable borrow (such as the sand and gravel lenses referenced in the glacial alluvial deposits) or obtained from a commercial source. Table 15 is a summary of anticipated material and volumes based on the conceptual layouts for Alternative 3.

**Table 15. Estimated Facility Volumes, Alternative 3.**

| Facility | Volume (million cubic yards) |
|---|---|
| Starter Dam | 1.7 |
| Rock Toe Berm | 2.7 |
| Cyclone Sand Dam | 22.2 |
| Saddle Dam | 0.7 |
| Seepage Collection Pond Fill | <0.1 |

#### *2.5.3.5.5 Seepage Collection*

In Alternative 3, a seepage collection system similar to that proposed in Alternative 2 would be used. A system of trunk drains and smaller lateral drains over the impoundment floor and beneath the tailings dam would convey seepage to the toe of the dam (Figure 26). Smaller secondary drains would convey water laterally into the trunk drains. It is assumed tailings seepage would be equal to the flow rates estimated for Alternative 2. For example, the estimated seepage flow rate into the foundation below the impoundment is 25 gpm and the seepage water from tailings consolidation is based on 75 percent of consolidation water migrating downward and 25 percent moving upward into the surface pond.

Artesian conditions are present along the toe area of the dam footprint. A drainage collection system would be designed (similar to Alternative 2) and installed under the Rock Toe Berm and extend upstream under the Main and Starter dam footprints as necessary to collect and control ground water. The Rock Toe Berm would be designed as a separate facility, but with its base layer

compatible with the underlying drain system. Design of the ground water drain system in the toe area of the dam would be separate from the tailings impoundment seepage collection system to enable separate monitoring of the two systems prior to discharge into the Seepage Collection Pond. Final design of the ground water drain system would consider the need and benefit of a seepage collection trench along the toe of the dam upstream of the private property (Figure 26).

Drain designs (both gravity and pressure relief drains) would be similar to those used in Alternative 2. Drains within the impoundment would be installed in trenches into the native ground and covered with a permeable protective layer to prevent erosion and plugging of the drains during initial placement of the tailings (Figure 26). During construction of the seepage collection and drain system, any wetlands uphill of the Main Dam would be filled. All drains would be placed in a geomembrane-lined trench and consist of a core of highly pervious 1- to 4-inch rock wrapped in geotextile and surrounded by sand and gravel filter material. Locally available sand and gravel alluvial material would be used to cover the drains to prevent the fine tailings from piping into the drain materials during operations. Seepage collection drains through and under the dam footprint would be designed as integral parts of the dam foundation and compatible with each of the overlying dam sections. MMC has committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards. The pumpback recovery wells would be located beyond the dam toe, and would be designed to collect seepage not collected by the drain system.

A Seepage Collection Pond and return facility would be 500 feet west of Libby Creek, 500 feet downstream of the impoundment. The facility design would include collection of water from the impoundment seepage collection drains, the ground water relief drains, and runoff from the downstream slope and toe area of the tailings dam facility. The pond would have a crest elevation of 3,240 feet and be lined with HDPE (or equivalent). The outside compacted fill slopes would consist of material excavated from the pond area and graded to have 2.5H:1V slopes. The perimeter crest would be 30 feet wide for maintenance purposes. The design criteria for the pond would be to contain up to 30 days of drain flow plus runoff from the 6-hour PMP storm event. (The Seepage Collection Pond in Alternative 2 was designed to accommodate the smaller 100-year/24-hour storm.) The capacity of the Seepage Collection Pond shown in Figure 26 is 153 acre-feet (50 million gallons).

A pump station would be located on the west side of the Seepage Collection Pond (Figure 26). The return water pipelines would plumb either into the return water lines in the thickener plant, or into the tailings facility where the water would combine with the tailings water and then would be recovered through the tailings impoundment return water system. The pumps would be rated at 125 percent of the estimated maximum flow into the ponds.

#### 2.5.3.6 LAD Area Modifications

The boundary for the permit and disturbance areas in the LAD Areas 1 and 2 would be modified to avoid old growth and IRAs (Figure 22 and Figure 28). Waste rock would be stored at the impoundment site. LAD Area 1 would be the primary LAD site and would provide 200 acres of land application area (Geomatrix 2007a). LAD Area 2 would be used as necessary and would provide 100 acres of land application area. The timber harvest areas in MMC's proposed LAD Area 2 would be a supplemental LAD Area and would be developed only in the event that supplemental LAD would be necessary to dispose of wastewater (Figure 28). The water balance for Alternative 3 is discussed in more detail in section 2.5.4.3, *Water Use and Management.*

### 2.5.3.7 Subsidence

Subsidence is the sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion. Subsidence is a concern because the underground mine would be beneath the CMW. In addition to MMC's proposed underground geotechnical monitoring discussed on page 55, MMC would implement the following measures to reduce the risk of subsidence:

- **Pre-mine Survey**—MMC would install several surface elevation monitoring points over the ore body, working with the lead agencies on the location of these survey sites. The primary focus would be in the initial mining areas or the mining zones closest to the surface. MMC would monitor these sites for movement using conventional surveying at an appropriate accuracy level (0.01 foot). Monitoring would occur prior to mining activities and would occur during and after mining operations or as appropriate based on site-specific geotechnical data. The agencies and MMC could modify the surface monitoring activities based on underground geotechnical data collected by the company during mining operations.
- **Pillar Design**—Using publicly available data (Davidson 1987), the pillar design at the Troy Mine that led to the pillar failure would be back-analyzed to compare the Troy Mine design in effect at the time of the failure with the Montanore design. As pillar designs were refined, numerical modeling would be undertaken to further evaluate expected design performance, including the potential for shear failure at the pillar/roof or pillar/floor interface.
- **Structural Setting**—Improving the understanding of the structural setting, including faulting, jointing, bedding, and the horizontal stress regime would improve the geotechnical design. The description of the Troy Mine pillar design (Davidson 1987) indicates that adverse pillar orientation with regard to bedding dip may have played a role in the pillar collapse, and the Troy Mine sinkhole events appear to be related to faulting. Hydrologic effects could be exacerbated by reactivation of fault zones, such as the Rock Lake Fault or any sympathetic and/or undocumented faulting that may exist. A better understanding of the structural environment at Montanore would benefit the mine design effort and improve the understanding of potential impacts that may arise. These data would be obtained through lineament analysis, mapping and statistical analysis of joint frequency and attitude, strain-relief overcoring, and further exploratory drilling.
- **Interaction of Workings**—MMC has completed some initial numerical modeling to examine the issue of pillar columnization and sill stability between the two ore zones. The modeling would be expanded during final design, as interaction of workings may be crucial to overall pillar/sill stability.
- **Entry Stability and Primary Support**—Roof support analyses would be completed during final design to finalize the support plan and mining span.
- **Final Plan Submittal**—MMC would submit a final mine plan, including final plans for geotechnical monitoring, following completion of the Libby Adit evaluation program to the agencies for approval.

#### 2.5.3.8 Other Modifications

##### *2.5.3.8.1 Reporting*

MMC would submit as part of its annual report to the lead agencies a discussion of its compliance with all the monitoring and mitigation requirements specified in the DEQ Operating Permit and the KNF's approved Plan of Operations. Each monitoring and mitigation requirement of the selected alternative would be listed in the report.

##### *2.5.3.8.2 Sound*

MMC would operate all surface and mill equipment so that sound levels would not exceed 55 dBA, measured 250 feet from the mill for continuous periods exceeding an hour. Backup beepers may exceed 55 dBA 250 feet from the mill. MMC would adjust intake and exhaust ventilation fans in the Libby Adits so that they generate sounds less than 82 dBA measured 50 feet downwind of the portal. If necessary, specially designed low-noise fan blades or active noise suppression equipment would be used.

##### *2.5.3.8.3 Scenery and Recreation*

MMC would design and construct a scenic overlook with information and interpretive signs south of the switchback on NFS road #231 (Libby Creek Road) above Howard Creek with views of the Libby Adit Site. MMC would develop two interpretative signs, one on the mining operation and another one on the mineral resource and geology of the Cabinet Mountains. Parking would be developed in cooperation with the KNF.

MMC would gate certain roads currently open in the mine permit areas during operations (see section 2.5.4.5, *Transportation and Access*). These roads would be different in Alternative 4. The KNF would change the access to other roads for wildlife mitigation (see section 2.5.7.3, *Wildlife Mitigation*). In Alternatives 3 and 4, MMC would check the status of the closure device twice-a-year (spring and fall), and repair any gate or barrier that was allowing access.

MMC would fund a volunteer campground host from Memorial Day through Labor Day at Howard Lake Campground during the construction and operation phases of the mine. MMC would shield or baffle night lighting at all facilities.

### 2.5.4 Operations Phase

#### 2.5.4.1 Mining

The mine plan would be the same as Alternative 2. If hydrologic modeling during initial mine operations (by Year 5 of operations) determined that one or more bulkheads would be necessary to minimize changes in East Fork Rock Creek and East Fork Bull River streamflows, MMC would submit a plan for bulkheads to the agencies for approval. One or more bulkheads would be maintained underground, if necessary, after the plan's approval.

#### 2.5.4.2 Tailings Management

##### *2.5.4.2.1 Main Dam*

The Main Dam would be a compacted cyclone sand dam constructed by the centerline method to an elevation of 3,664 feet (Figure 26 and Figure 27). A crest width of 70 feet was used to account for the upstream slope of the sand deposition and working crest area for the proposed cyclone towers. The downstream slope was set at 2.75H:1V and would be buttressed by a Rock Toe Berm

described above. Based on the height and position of the Rock Toe Berm, the vertical height of the Main Dam would be 230 feet above the Rock Toe Berm crest (Figure 26 and Figure 27). The final crest length would be 10,300 feet, and the main north-south axis would be 5,000 feet long. The left and right abutment sections would be both angled back at about 75 degrees from the main section centerline and tie into the existing ground at the crest elevation (Figure 26). The dam would be raised with cyclone underflow sand hydraulically placed and compacted in cells as described for Alternative 2. The cyclone overflow (fine tailings fraction) would be routed to the tailings thickener plant and combined with the primary thickener underflow and thickened to a 70 percent slurry density.

#### *2.5.4.2.2 Tailings Deposition*

For Alternative 3, it is assumed that all tailings deposited into the impoundment would be routed through a thickener plant and deposited as high-density tailings. This would allow a higher average in-place tailings density and stacking of tailings along perimeter areas above the Main Dam crest. Both parameters lead to a reduction in the total impoundment volume required to store conventional tailings slurry.

Tailings slurry would be pumped in buried double-walled HDPE pipelines from the mill at the Libby Plant Site to a thickener facility west of the impoundment. The thickener facility would remove water, or dewater, the tailings to a target slurry density of about 70 percent solids and deposited to achieve an average in-place tailings density of 85 p or greater. Water removed from the tailings would be sent to the water storage pond on the north end of the Poorman Tailings Impoundment (Figure 26).

**Tailings Pipelines**

Tailings pipelines and reclaim water lines between the impoundment and the mill would be the same design as Alternative 2. In Alternative 3, MMC would bury tailings pipelines in the proposed access road between the Libby Plant Site and the Poorman Impoundment Site. Pipelines would be buried at least 2 feet deep adjacent to the access road. Consequently, the ditch proposed by MMC in Alternative 2 would not be constructed. In addition to the pump station at the Poorman Creek crossing proposed in Alternative 2, another pump station, similar to the Poorman Creek pump station, would be needed at the Ramsey Creek crossing. These pump stations would be outside of the 100-year floodplain to comply with INFS requirements.

Tailings pipelines would be double-walled to reduce the risk of leaks; one type of pipeline used successfully at the Stillwater Mine complex consists of a HDPE pipe inside a steel pipe. The leak detection system proposed by MMC would be used. Burying the pipelines would provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the tailings thickener plant. The pipelines would be visible at the two above-ground crossings of Ramsey and Poorman creeks. Once the pipelines were no longer needed, they would be flushed out into the tailings impoundment. They would be removed from all stream crossings and anywhere they were less than 3 feet below the surface. For other segments of the pipelines, the pipelines would be left in place. They would be cut at 0.5-mile intervals, and capped.

**Thickener Facility**

It is anticipated that either a high compression thickener or a deep tank thickener system would be required to remove sufficient water for the slurry to create a 70 percent slurry density. A high compression thickener is basically a high rate thickener with higher sidewalls so that a higher

mud level is maintained in the thickener. This produces a higher percent solids underflow, referred to as high-density slurry. The deep tank thickener has a high sidewall so that the aspect ratio of diameter to height is about 1:1. The higher mud level and residence time results in higher percent solids than the high compression thickener. The appropriate selection would be based on a series of rheology tests (test to evaluate the physical relationship between the slurry density and size/material type of the pipe to determine the "pumpability" of the slurry) using representative tailings samples. The number of thickeners would depend on the test results coupled with the production rate. The plant would be expanded in stages to accommodate the increasing tailings production rate over time (from 12,500 to 20,000 tons per day). The water removed from the tailings slurry would be routed to the storage pond in the impoundment and then returned to the mill as make-up water.

The area required for the facility would depend on final design and arrangement of the thickeners. An area up to 300 feet by 200 feet would be located above the impoundment area. The main building and any exterior thickeners/facilities would be painted to help reduce visual impacts. Vegetation surrounding the thickener plant would be retained or planted to help visually blend the plant site with adjacent hillsides. The thickener plant would be designed to receive, dewater, and pump up to 20,000 tons of tailings per day.

#### Pumping and Deposition

The selection of pumping equipment would depend largely on the type of thickener selected, the pumping pressures required, and rheology of the tailings. Either centrifugal pumps or positive displacement pumps likely would be required for this alternative. The selection would be determined as part of final design studies.

Initially, the high-density slurry would be applied to the ground surface from the crest of the Starter Dam and initial raises of the Main Dam, and retained by a Starter Dam and subsequent Main Dam similar to Alternative 2. Deposition from the dam crest would continue through about Year 5 of operation to establish a back slope for the upstream side of the sand dam and a contact with the tailings slurry. After about Year 5, the thickened tailings would be deposited to the ground from multiple points upslope of the tailings impoundment area to form several mounds of tailings. As tailings deposition continues, the slope of the mounded tailings would overlap and migrate down into the impoundment area. The thickened tailings would form a surface at about a 3 to 5 percent gradient to create a slope of tailings graded down into the impoundment area (Figure 29). The mass of tailings deposited to form the slope would be balanced with the tailings volume within the impoundment area so as not to exceed the height of the Main Dam and provide adequate solution and storm water management capacity within the impoundment area. The last year or two of operation, tailings would be deposited to facilitate final closure of the facility with surface water drainage reporting to the northern corner of the impoundment. Distribution pipelines around the impoundment would be surface mounted for maintenance and operation purposes.

The functionality of Alternative 3 would depend on determination and design of the water removal system (such as deep tank or high compression thickeners) and the strict control of final slurry parameters such as moisture content, deposition sequences, and impoundment water management. During final design, MMC would determine the proper thickener and distribution system and deposition plan for the tailings. MMC would develop an optimum filling plan and operation and monitoring manual that address plant operations, tailings thickening parameter tolerances, contingencies for tailings density not meeting specifications, monitoring of the

thickening process, and reporting to the lead agencies. Similar monitoring and reporting for the tailings impoundment as proposed in Alternative 2 would be implemented for Alternative 3.

### 2.5.4.3 Water Use and Management

#### *2.5.4.3.1 Project Water Requirements*

The water balance in Alternative 3 would have the same components as MMC's projected water balance in Alternative 2. It is based on the same assumptions regarding precipitation and evaporation used in Alternative 2. MMC would maintain a detailed water balance that would be used to monitor water use. Actual volumes for water balance variables (*e.g.*, mine and adit inflows, precipitation and evaporation, and dust suppression) would vary seasonally and annually from the volumes shown in Table 16.

**Table 16. Average Process Water Balance, Alternative 3.**

| Mine-Related Facility | 800 GPM Inflow (gpm) | 1,200 GPM Inflow (gpm) |
|---|---|---|
| **Mine and Adit Inflows** | | |
| Total estimated inflows | 800 | 1,200 |
| Discharge to LAD Areas with any necessary treatment | 307 | 707 |
| Net inflow to mill | 493 | 493 |
| **Mill Inflow** | | |
| Net inflow from mine/adit | 493 | 493 |
| Stored water from tailings impoundment | 702 | 702 |
| Make-up water | 0 | 0 |
| Subtotal | 1,195 | 1,195 |
| **Mill Outflow** | | |
| Water transported with tailings | 1,186 | 1,186 |
| Water in concentrate | 9 | 9 |
| Subtotal | 1,195 | 1,195 |
| **Tailings Impoundment Inflow** | | |
| Precipitation | 427 | 427 |
| Thickener and cyclone under- and overflows | 924 | 924 |
| Water released from tailings consolidation | 282 | 282 |
| Runoff captured by seepage collection pond | 132 | 132 |
| Runoff captured by tailings impoundment | 203 | 203 |
| Subtotal | 1,967 | 1,967 |
| **Tailings Impoundment Outflows** | | |
| Dust suppression | 60 | 60 |
| Evaporation | 396 | 396 |
| Water stored in tailings | 784 | 784 |
| Seepage into ground water | 25 | 25 |
| Water recycled to mill | 702 | 702 |
| Subtotal | 1,967 | 1,967 |

If inflows were less than 450 gpm, make-up water would be needed for the mill. The amount of make-up water required would depend on the configuration of the tailings impoundment, as

precipitation and evaporation at the tailings impoundment are important factors in the water balance. The lead agencies completed an analysis of the make-up water requirements using the Little Cherry Creek Tailings Impoundment as proposed in Alternative 2 and assuming inflows of 450 gpm. Using the Poorman Impoundment Site, 50 gpm make-up water would be required at a steady-state inflow rate of 450 gpm or less. At steady-state flows greater than 500 gpm, make-up water would not be necessary. A water supply well field located north of the Seepage Collection Pond would be used to provide make-up water by drawing from Libby Creek alluvial ground water (Figure 26). Streamflow data indicate this segment of Libby Creek is a gaining reach, likely from ground water flow from glaciofluvial deposits to the west and fractured bedrock aquifers (Geomatrix 2007a). In Alternatives 3 and 4, MMC would not withdraw water for make-up water purposes between August 1 and October 31 if the water source were hydrologically connected to Libby Creek. Potable water needs are expected to be small (11 gpm) and could be withdrawn year-round. As in Alternative 2, MMC would notify the lead agencies if long-term make-up water would be necessary. MMC would modify the aquatic life monitoring plan to take into account such withdrawals. Withdrawals would not proceed until the lead agencies' approval of an updated aquatic life monitoring plan. MMC would need to conduct appropriate pumping tests, and acquire the appropriate water rights from the DNRC during final design.

Maintaining a large pool of water at the toe of "stacked" tailings may affect the feasibility of the depositing high-density tailings slurry above the dam crest in excess of the impoundment capacity created by the dam. In final design, MMC would need to revaluate the water balance and the deposition plan. One option would consider a dam alignment and deposition plan that used the drainage in the northern end of the impoundment area as a dedicated water storage area, at least until the final few years of operation and then infill if needed as part of final deposition and contouring for reclamation. Preliminary evaluation found this may be possible with only minor changes to the Alternative 3 layout and site development. A second option would be to include the Seepage Collection Pond for excess water storage. The operating criteria included in the Alternative 3 water balance estimate had all collected water returned to the system and no accumulated storage in the Seepage Collection Pond.

##### *2.5.4.3.2 Wastewater Discharges*

MMC would maintain the current MPDES permit MT0030279 with three outfalls at the Libby Adit Site. Additional discharges would require DEQ authorization. Potential discharges of wastewater associated with Alternative 3 are:

- Seepage or percolation to ground water beneath LAD Areas 1 and 2
- Surface water runoff from LAD Areas 1 and 2
- Seepage or percolation to ground water beneath the Poorman Tailings Impoundment

##### *2.5.4.3.3 Storm Water Control*

Sediment and runoff from the tailings facility would be minimized by limiting unreclaimed areas to the active disposal areas. Localized sediment retention structures and BMPs would be used in the downslope perimeter of the impoundment for control, sampling, and recovery of drainage from the tailings thickener facility, sediment, and storm water runoff. These structures and collection ditches would act as storm water diversions to channel the water and sediment from the active portion of the tailings thickener facility into storm water ponds. The ditches also would be sized to accommodate a 10-year/24-hour storm event.

Storm water from undisturbed lands above the tailings facility would be diverted around the active portions of the Impoundment Site into Poorman Creek during mine operations. Runoff from reclaimed and fully revegetated, stabilized portions of the tailings thickener facility would be diverted to settling basins before mixing with runoff from undisturbed areas. Settling ponds for runoff from newly reclaimed areas along the perimeter of the tailings thickener facility would be unlined but vegetated, and would drain through a constructed drainage network to existing intermittent drainages. Storm water from reclaimed areas that were not fully stabilized would be captured along with runoff from the active areas of the tailings facility. Undisturbed portions of the facility would either drain into existing drainages or be diverted away from active areas, soil stockpiles, and the storm water pond. All diversions would be sized to handle a 10-year/24-hour storm event. The diversions would be reclaimed and permanent drainageways established when mine operations ended and the site fully reclaimed.

In Alternative 2, MMC proposes to use water and/or chemical stabilization for dust suppression on mine access roads during operations. Mine, adit, or tailings pond water is expected to have elevated suspended soils, nutrients (nitrates), and heavy metals (see section 3.12.2.3.4, *Wastewater Quality*). These compounds could enter surface water if water for dust suppression ran off of the roads. To reduce the potential for adversely affecting water quality in Alternative 3, MMC would use either a chemical stabilization, ground water, or segregated mine or adit water with nitrate concentrations of 1 mg/L or less and with concentrations of all other parameters below the mine drainage ELG, to control dust on mine access roads.

#### *2.5.4.3.4 Water Use and Management*

**General Water Treatment**

MMC proposes in Alternative 2 to use the LAD Areas for primary treatment of excess mine and adit inflows. Currently, MMC has proposed and is permitted by the DEQ under Operating Permit #00150, Minor Revision 06-002, to treat Libby Adit inflows through an existing water treatment plant before discharge to approved Libby Adit Site outfalls. No discharge of Libby Adit water to the LAD Areas is approved as part of Minor Revision 06-002.

The existing Libby Adit Water Treatment Plant would be used if necessary to comply with water quality standards or BHES Order limits to reduce concentrations in adit and mine inflows prior to disposal at the LAD sites. The agencies assumed nitrates would be reduced by 90 percent if pretreatment were necessary before discharge at the LAD Areas. After water treatment, MMC has operational capacity to discharge treated wastewater at the MPDES permitted outfalls at the Libby Adit. As section 3.12.2.3.4, *Wastewater Quality* discusses, MMC expects nitrate concentrations in pumped adit and mine inflows to range from 15 to 25 mg/L. These nitrate concentrations are lower than measured in adit discharges from the Libby Adit when it was initially driven by Noranda between 1989 and 1991. MMC expects lower nitrate concentrations than experienced by Noranda because of its plans to use explosive emulsions and better housekeeping (Geomatrix 2007a). In Alternative 3, in addition to the existing water treatment plant at the Libby Adit, another water treatment system may be necessary at higher wastewater volumes to comply with water quality standards or BHES Order limits prior to disposal at the LAD Areas.

**LAD Area Modifications**

MMC's proposed access road to LAD Area 1 and the Waste Rock Stockpile in LAD Area 1 would disturb old growth and RHCAs. Old growth and RHCAs are discussed in sections 3.21.2, *Old*

*Growth Ecosystems* and 3.6.3.12.17, *Riparian Habitat Conservation Areas*, respectively. The boundary for the operating permit and disturbance areas would be adjusted to reflect this modification to avoid those areas (Figure 28). LAD Area 1 would be the primary LAD site and, in combination with the LAD Area 2, would provide about 300 acres where up to 198 gpm of treated water could be discharged through infiltration. Discharges of up to 198 gpm were used for purposes of analysis; discharge volumes may vary and would be based on compliance with water quality standards. Based on the lead agencies' analysis, MMC should have adequate capacity to manage excess water volumes at the existing Libby Adit Water Treatment Plant and outfalls or at the two LAD Areas. If additional capacity were needed, MMC would implement the measures discussed in Alternative 2 to reduce inflows or manage excess water. Stormwater runoff from the LAD Areas would be captured in a lined stormwater retention pond, and discharged to Poorman Creek via a constructed channel designed to minimize erosion.

#### 2.5.4.4 Solid Waste Management

MMC's proposal in Alternative 2 to store buried sewage tanks adjacent to the mill/office building and then disposed off-site would be modified in Alternatives 3 and 4. MMC would submit plans and specifications for public water supply wells, as well as plans for construction of a sanitary waste treatment facility to the DEQ for approval. MMC would treat all sanitary wastes to the degree necessary to meet MPDES effluent limits. After treatment, sanitary wastes would be either recycled to the mill for process water, or discharged as wastewater to the LAD Areas.

In Alternative 2, MMC would occasionally bury certain wastes underground in mined-out areas. In Alternative 3, MMC would minimize the amount of wastes underground or at the tailings impoundment. All wastes proposed for disposal underground or at the tailings impoundment would be identified during operations and at closure, and reviewed and approved by the agencies prior to disposal.

#### 2.5.4.5 Transportation and Access

##### *2.5.4.5.1 Road Management Plan*

INFS standard RF-2 requires the development and implementation of a Road Management Plan. In Alternatives 3 and 4, MMC would develop for the lead agencies' approval, and implement a final Road Management Plan that would describe for all new and reconstructed roads used for the mine and transmission line the following:

- Criteria that govern road operation, maintenance, and management
- Requirements for pre-, during-, and post-storm inspections and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives
- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control
- Mitigation plans for road failures

The plan would incorporate safety signing such as "Caution Truck Traffic" signs at several locations between U.S. 2 and the Libby Plant Site on both Libby Creek and Bear Creek roads. Other appropriate wording could be used as approved in the Road Management Plan. The plan would describe management of road surface materials during plowing, such as snow and ice.

Sidecasting of soils or snow would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs in priority watersheds.

#### *2.5.4.5.2 Bear Creek Road (NFS Road #278) and Libby Creek Road (NFS Road #231)*

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278), Libby Creek Road (NFS road #231), and each proposed permit area. With the exception of the Bear Creek Road, all open roads in the impoundment permit area would be gated and limited to mine traffic only. Non-motorized public access would be restricted within each permit area by signage at the permit area boundary. Table 17 lists those roads with a change in road status in Alternative 3; these roads are shown on Figure 30.

As discussed previously, the agencies incorporated the Libby Adit evaluation program into Alternatives 3 and 4. MMC would plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. MMC would install a gate on the Libby Creek Road and maintain the gate and the KNF would seasonally restrict access on the two roads as long as MMC uses and snowplows the two roads. Culverts along all access roads that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards, such as fish passage or conveyance of adequate flows. Any work in a RHCA along an access road would be completed in compliance with INFS standards and guidelines.

In Alternative 3, MMC would use the Bear Creek Road as in Alternative 2 for main access during operations (Figure 2). About 13 miles of the Bear Creek Road (NFS road #278), from U.S. 2 to the Poorman Tailings Impoundment Site, would be paved and upgraded to a roadway width of 26 feet. Additional widening would be necessary on curves. The disturbed area, included ditches and cut-and-fill slopes, is expected to be up to 100 feet wide. The existing Bear Creek bridge, which currently is 14 feet wide, also would be replaced and widened to a width compatible with a 26-foot wide Bear Creek Road. During upgrading of the Bear Creek Road, MMC would use the Libby Creek Road. A travel lane on the Bear Creek Road would be maintained to allow continued motorized public access. During operations, MMC would use a supply staging area in Libby where shipments to the mine site would be consolidated.

South of Little Cherry Creek, MMC would build 3.2 miles of new road west of Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781) (Figure 30). The new road would be designated NFS road #278 (the new Bear Creek Road) and would generally follow the 3,800-foot contour to north of the Poorman Creek bridge. To maintain a public access connection between the Bear Creek Road and the Libby Creek Road (NFS road #231), the public would use the new Bear Creek Road, a segment of the Poorman Creek Road (NFS road #2317), and a segment of the Bear Creek Road south of Poorman Creek. The crossing of the new Bear Creek Road across Poorman Creek would be built to accommodate the 100-year flow event and be constructed in compliance with INFS standards. It would either be a bridge or arched culvert. The crossing width would be consistent with the roadway width.

The newly-abandoned Bear Creek Road (NFS road #278) between the Libby Plant Access Road and just north of Poorman Creek and on a segment of the Little Cherry Loop Road (NFS road #6212) would be gated during operations and used exclusively for mine traffic and public access would be eliminated (Figure 30). The gates on the Little Cherry Loop Road (NFS road #6212) would be near the tailings impoundment permit area boundary on the north end and near its intersection with the Bear Creek Road south of Poorman Creek on the south end.

**Table 17. Proposed Change in Road Status during Operations, Alternative 3.**

| Road # | Road Name | Location | Existing Status | Length (miles) | Proposed Status |
|---|---|---|---|---|---|
| 2317B | Poorman Creek B | LAD Area 2 | No closure order, impassable | 0.8 | Gated, mine traffic only |
| 278X | Bear Creek X | LAD Area 2 | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 1.0 | Gated, mine traffic only |
| 4781 | Ramsey Creek | LAD Area 2 | Open | 0.3 | Barriered year-long to motor vehicles |
| 4781 | Ramsey Creek | LAD Area 1 up Ramsey Creek | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 3.2 | Barriered year-long to motor vehicles |
| 5170 | Poorman Creek Unit | LAD Area 2 | Open | 0.2 | Gated, mine traffic only |
| 5186 | Ramsey Creek Bottom | LAD Area 2 | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Gated, mine traffic only |
| 14403 | Lower Ramsey | Libby Plant Site | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Gated, mine traffic only |
| 6201 | Cherry Ridge | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 1.3 | Gated, mine traffic only |
| 6201A | Cherry Ridge A | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.9 | Gated, mine traffic only |
| 6212 | Little Cherry Loop | Tailings Impoundment | Open | 2.1 | Gated, mine traffic only |
| 6212L | Little Cherry Loop L | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.5 | Gated, mine traffic only |
| 6701 | South Ramsey Creek | Upper Ramsey Creek | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Barriered year-long to motor vehicles |

MMC would surface the existing Bear Creek Road (NFS road #278) from just south of Poorman Creek to the Libby Creek Road (NFS road #231) with 6 inches of gravel 16 feet wide (Figure 30). This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

Similar to Alternative 2, MMC would use open and closed roads in Alternative 3. Some currently open roads would be gated. As part of the lead agencies' mitigation, MMC would be responsible for installing and maintaining gates at each closure. The gates would have dual-locking devices to allow the KNF fire or administrative access. When accessing areas regulated by the Mine Safety and Health Administration, KNF personnel would check in at the mine office before entering regulated areas.

#### *2.5.4.5.3 Poorman Tailings Impoundment Area*

The roads used to haul waste rock from the Libby Adit and the Upper Libby Adit to the Poorman Tailings Impoundment Area are shown on Figure 30. Except of a segment of the Upper Libby Creek Road (NFS road #2316) and the Poorman Creek Road (NFS road #2317) in LAD Area 2, mine haul roads would be restricted to mine traffic only. Because of the joint use on these two roads (Figure 30), they would be widened to accommodate haul truck traffic and another lane of public traffic. The joint-use road segments would be widened to widths recommended by the Mine Safety and Health Administration (Mine Safety and Health Administration 1999). For a 16-foot wide haul vehicle, the road width would be 56 feet wide to accommodate joint-use traffic safely. MMC would use a segment of the existing Bear Creek Road north of LAD Area 2 for mine haul.

The crossing of the old Bear Creek Road across Poorman Creek would be built to accommodate the 100-year flow event and be constructed in compliance with INFS standards. It would either be a bridge or arched culvert. The crossing width would be consistent with the roadway width.

Besides Bear Creek Road, Little Cherry Loop Road (NFS road #6212) is the only other road within the Poorman Tailings Impoundment area that is open to public, motorized access. MMC would close Little Cherry Loop Road within the proposed permit area boundary to public access and would use it during the construction, operation, and closure of the Poorman Tailings Impoundment. NFS road #6212 would remain open north of the proposed permit area boundary to the junction with Bear Creek Road. The following closed National Forest System roads within the impoundment area would be used in Alternative 3: #1408 to the private land in the NW¼, Section 25, Township 28 North, Range 31 West, #5181, #5181A, #5185, #5185A, #5187, #6212H, #6212L, #6212M, and #6212P (Figure 30).

#### *2.5.4.5.4 LAD Areas 1 and 2*

No open roads are within the proposed permit area for LAD Area 1. A short segment of the Poorman Creek Road (open NFS road #2317) is near the northern boundary of the LAD Area 1 permit area. In Alternative 3, the currently open segment of the Poorman Creek Road would remain open and be used to access LAD Area 1. MMC would develop a small unpaved recreational parking area near the intersection of the Libby Plant access road and Poorman Creek Road (Figure 28). A parking area would facilitate non-motorized access to the Poorman Creek drainage via the Poorman Creek Road. MMC also would develop a new hiking trail between Poorman and Ramsey creeks to provide non-motorized access to upper Ramsey Creek.

A short segment of the Ramsey Creek Road (NFS road #4781) on the eastern and southern boundaries of the LAD Area 1 is open. MMC would close this segment to public access and use it for mine haul traffic. MMC also would use the closed NFS road #2317B for access within LAD Area 1. As in Alternative 2, two currently barriered roads (NFS road #278X and #5186, and 0.2 mile of open NFS road #5170 would be gated and used for mine traffic only (Figure 30).

##### *2.5.4.5.5 Libby Plant Site, Libby Adit and Upper Libby Adit*

MMC would use the same roads (NFS road #4781, NFS road #6210 between Ramsey Creek and Libby Creek, and NFS road #2316) for access to the Libby Adit Site and Libby Plant Site (Figure 30). Modifications to these roads also would be the same as Alternative 2, except for a segment of NFS road #2316 west of NFS road #6210. A segment of NFS road #2316 west of the Libby Adit Site would provide access to the Upper Libby Adit Site. Because NFS road #2316 is currently open to the public, it would be widened to 56 feet accommodate joint public/mine haul traffic.

A new bridge across Ramsey Creek would be needed. The bridge would accommodate the 100-year flow event and be constructed in compliance with INFS standards. Bridge width would be compatible with the roadway width. A short segment of closed NFS road #14403 would provide access to the Libby Plant soil stockpile.

##### *2.5.4.5.6 Ramsey Creek Drainage*

Access and road use on NFS road #4781 up Ramsey Creek and NFS road #6701 would change from gated to barriered to provide grizzly bear mitigation.

## 2.5.5 Reclamation Phase

Short- and long-term reclamation objectives would remain the same as for Alternative 2. These objectives would be achieved through interim and final reclamation of all disturbed sites as described for Alternative 2, with additional mitigation described below and implementing all erosion- and sediment-control measures described for Alternative 2.

### 2.5.5.1 Post-Mining Topography of Project Facilities

The post-mining topography of project facilities would follow the procedures outlined for Alternative 2 with the following modifications. MMC would develop final regrading plans for each facility to reduce visual impacts of reclaimed mine facilities. These plans would require the agencies' approval prior to implementation. At the end of operations, any waste rock not used in construction would be either placed back underground or used in regrading the tailings impoundment. Waste rock used at the Libby Plant Site could require an MPDES permit modification to include runoff or seepage from the waste rock.

MMC would develop plans to shape slopes of the Libby Plant Site (Figure 31), mine portal areas, and Libby Adit Site to closely resemble the surrounding landscape. Final grading would involve regrading and shaping flat surfaces to blend with the adjacent landscape and have natural dendritic drainages. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms.

#### *2.5.5.1.1 Poorman Tailings Impoundment*

Deposition of the tailings at closure would produce a final surface as shown in Figure 32. As part of reclamation, all surface facilities would be removed from the site. Inert materials may be buried within the tailings facility prior to placement of final cover. MMC would provide a list of

material and items to be buried and a cover plan for burial to the lead agencies for approval prior to burial of the items and materials. Once all water had been removed (evaporated, treated, and discharged) from the tailings surface in the northern area, and the near surface tailings have stabilized for equipment access, a channel would be excavated through the tailings and Saddle Dam abutment to route runoff from the site toward a tributary of Little Cherry Creek. The channel would be routed at no greater than 1 percent slope and along an alignment requiring the shallowest depth of tailings to be excavated down to the channel grade. The side slopes would be designed to a stable slope and covered with coarse rock to prevent erosion. The channel section through the abutment would be backfilled with a porous dam section designed to retain the PMF and dissipate the flood water at a flow rate of 2 cfs or within a 60-day period, whichever flow rate is the greater. This design would allow discharge runoff from the site and minimize channel stabilization in the drainage above Little Cherry Creek and water quality impacts to the receiving waters in Little Cherry Creek.

The tailings surface and disturbed areas would be covered as outlined Alternative 2. MMC would survey tailings settlement at closure on a 100-foot by 100-foot grid to document settlement. The area would be surveyed after borrow material used for fill was placed to create final reclamation gradients, and again after soil placement to ensure runoff gradients were achieved and soil thicknesses were met. Rocky borrow and geotextile be needed for construction equipment to work on the tailings surface. In Alternative 2, MMC would place riprap on the dam crest and uppermost part of the dam face to minimize potential gully formation at the tailings dam crest. In Alternative 3, MMC would use rocky borrow from within the disturbance area to provide erosion protection. Borrow material volumes would be determined during final design.

Post-operational seepage management would be the same as Alternative 2. MMC would operate the seepage collection and the pumpback well systems until water quality standards or BHES Order limits were met without additional treatment. Long-term treatment may be required if water quality standards were not met. The length of time these closure activities would occur is not known, but may be decades or more. Following removal of the Seepage Collection Dam, the disturbed area would be graded to blend with the original slope. After water quality standards or BHES Order limits were met, seepage from the underdrains and seepage not intercepted by the underdrains would flow to Libby Creek.

MMC would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape than proposed in Alternative 2. Sand deposition would be varied during final cycloning and placement of sand on the dams. This design would incorporate additional rocky borrow at selected locations on the dam face and use benches in some locations. Islands of trees and shrubs would be planted in the rocky areas. The seed mixture on the dam face would vary to reduce uniformity of the revegetated dam.

#### *2.5.5.1.2 Roads*

Reclamation of the Bear Creek Road, new roads, currently open roads, and all new bridges used in Alternative 3 would be the same as Alternative 2. The existing Bear Creek Road and the new Bear Creek Road from the Poorman Tailings Impoundment Site to south of Poorman Creek would remain chip-sealed and 26 feet wide. All currently gated or barriered roads used in Alternative 3 would be decommissioned by using a variety of treatment methods to achieve desired conditions for other resources. The existing culvert across Poorman Creek on the former Bear Creek Road (NFS road #278) and the existing bridge across Poorman Creek on the Little Cherry Loop Road (NFS road #6212) would be removed at closure and the area revegetated.

### 2.5.5.2 Revegetation

#### *2.5.5.2.1 Revegetation Success/Bond Release Criteria*

The following criteria for all reclaimed areas, including the transmission line right-of-way and access roads, would be used to determine revegetation success and bond release. Minimum vegetation cover would be 80 percent of the control site total cover. If the required minimum cover were not obtained, MMC would implement remedial action such as reseeding with a modified seed mixture, mulching, fertilizer, or other changes to address the issue. If after two remedial attempts the particular site still did not meet the minimum vegetative cover standard but met 80 percent of the average of selected control sites, did not exhibit rills or gullies, and met the weed standard, it would be released. If the site continued to fall short of meeting the cover requirement, a third remedial effort, approved by the lead agencies, would be applied. If the standard still were not met but the site had 70 percent of the control cover and did not exhibit rills and gullies and met the weed standard, it would be released.

MMC and the lead agencies would establish control sites for the project prior to operation activities. These sites should be similar to the reclaimed areas and be in close proximity to the mine area. MMC would develop a vegetation monitoring program from these sites and collect vegetation data during the mine life. This information would be used to validate the release criteria numbers with respect to minimum cover requirements, tree/shrub density, weeds, and other provisions preliminarily set during the EIS. The intent is to provide long-term site-specific data to support the release criteria established for the project. The monitoring plan would be approved by the lead agencies and would require the report be submitted annually or as outlined in the plan or as approved by the lead agencies. Monitoring would continue for 20 years after planting or seeding to ensure revegetation requirements have been met, or less if the project bond were released by the lead agencies before this period expired.

Noxious weeds would have less than 10 percent cover of species listed as Category 1 (existing infestations) and 0 percent cover of Category 2 and 3 (new invaders and potential invaders, as described in the KNF Noxious Weed Handbook, Spring 2008, Edition 5.0) in reclaimed areas. Data collected by MMC on control sites would be used to update/validate these values based on site-specific data. Noxious weeds would not dominate in any area greater than 400 square feet. No bare areas greater than 200 square feet would be allowed in reclaimed areas.

A minimum of 400 trees and 200 shrubs per acre would be living after 15 years (density would be lower in some areas where no trees or shrubs would be planted such as herbaceous wetlands and meadows).

#### *2.5.5.2.2 Seed Mixture Modifications*

MMC would revise all seed mixes so that mixes would be composed of species native to northwestern Montana. MMC would select seed mixes to be compatible with dry and moist forest conditions. On dry south-facing slopes, a seed mix with more aggressive plant species able to establish under harsh conditions would be used, while in moist areas, the aggressive species would be avoided. Native seed mixes would have the ability to be updated in conjunction with ongoing research and as more information becomes available, or as directed by the lead agencies. MMC would include introduced species only with prior approval from the lead agencies.

The interim and permanent seed mixes proposed for Alternative 2 contain introduced species (Table 18). In the proposed seed mixes, MMC would not use the species shown in Table 18, and

would replace them with native species, to the extent native species were commercially available. MMC would assess which native species were available commercially, and submit final permanent seed mixes to the lead agencies for approval. In the event native species were not establishing rapidly enough to control invasive plants, MMC would submit an alternative seed mixture to the lead agencies for approval. The alternative mixture could include non-native species that would meet the overall goals and objectives of the reclamation plan. MMC would conduct seeding between August 15 and October 31, or between April 1 and June 15. All areas would be seeded with the permanent seed mix; the interim seed mix proposed in Alternative 2 would not be used. Change in the seeding schedule would be approved by the lead agencies.

**Table 18. Introduced Species Eliminated from MMC's Proposed Seed Mixes.**

| Revegetation Mixture 1 | Revegetation Mixture 2 |
|---|---|
| Redtop (*Agrostis gigantea*) | Redtop (*Agrostis gigantea*) |
| Meadow foxtail (*Alopecurus pratensis*) | Orchardgrass (*Dactylis glomerata*) |
| Tall fescue (*Festuca arundinacea*) | Canada bluegrass (*Poa compressa*) |
| Timothy (*Phleum pratense*) | White clover (*Trifolium repens*) |
| White clover (*Trifolium repens*) | |

#### *2.5.5.2.3 Planting*

MMC cites recommendations for establishment of seedlings (not planting) ranging from 400 to 680 trees per acre, but plans 435 trees per acre and 200 shrubs per acre. At a success rate of 65 percent, this would yield 283 trees and 130 shrubs per acre, which would be at the low end of the densities recommended by KNF. In Alternative 3, MMC would plant sufficient trees and shrubs to achieve 400 trees and 200 shrubs per acre 15 years after planting.

To help prevent noxious weed establishment, MMC would plant trees and shrubs randomly by hand unless safety issues require machine planting. MMC would mulch around planted trees and shrubs, and control weeds adjacent to trees and shrubs, but apply native seed elsewhere. If noxious weeds colonized planting areas, and weed control with herbicides were necessary, trees would likely be lost. MMC would use an agencies-approved wood-based compost to promote fungi-based communities and tree growth rather than straw or manure based compost that promotes bacteria-based grassland communities.

#### *2.5.5.2.4 Organic Amendments*

MMC would amend the top 0 to 4 inches of soil before seeding with an agencies-approved wood-based organic amendment to raise the organic matter level in the soil to a minimum of 1 percent by volume.

#### *2.5.5.2.5 Noxious Weed Mitigation Measures*

MMC has a Weed Control Plan approved by Lincoln County Weed Control District. The plan would be modified as described in this section and submitted to the lead agencies during final design for their approval. Following KNF's and DEQ's approval of the final Weed Control Plan, MMC would submit it to the Lincoln County Weed Control District. These measures would be applied to all permit areas, and all currently unopened roads used for transmission line access.

MMC would submit an annual report to the lead agencies describing weed control efforts. The report would provide a map showing areas of weed infestation that were treated in the preceding year. It also would provide a qualitative evaluation of the weed control efforts.

MMC would implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a) for all weed-control measures. MMC would focus mitigation on prevention as the most effective and least expensive weed management strategy, and early detection and eradication as the best alternative once a new species had been introduced. For established invaders, treatment and containment of noxious weeds species would be the main objective. MMC would include integrated noxious weed management in the environmental training program.

MMC would comply with state and local laws and agencies' guidelines for all noxious weed-control activities. All herbicides used in the project area would be approved for use in the KNF, and would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity, and public health and safety. Herbicide selection and application timing would be based on target species on the site, site factors (such as soil types and distance to water), and with the objective to minimize impacts to non-target species. MMC would coordinate with the KNF Weed Specialist for use of biocontrol agents as they become available.

To the extent possible, MMC would survey all proposed ground disturbance areas for noxious weeds prior to initiating disturbance. Where noxious weeds were found, MMC would treat infestation the season before the activity was planned. For example, if timber clearing were planned to being in the spring, the survey and control would be implemented the previous fall. Areas surveyed would include roads, borrow areas, tailings impoundment, transmission line, LAD Areas, and any other areas designated for timber removal. MMC would describe in final design plans the extent of which surveys and pretreatment would not be feasible. The proposed survey and treatment approach would be a part of the final Weed Control Plan, to be reviewed and approved by the lead agencies.

MMC would include road-related weed mitigation in any road access that was approved for the project (including access routes to the transmission line). MMC would treat noxious weeds along all haul and access roads yearly with the appropriate herbicide mix for the target species. MMC would broadcast treat every other year and spot treat the alternate years.

MMC would minimize soil disturbance and mineral soil exposure during ground-disturbing activities. Ground disturbance should be no more than needed to meet project objectives. MMC would prevent road maintenance machinery from blading or brushing through known populations of new invading noxious weed species. In areas where noxious weeds were established and activities require blading, MMC would brush and blade areas with uninfested segments of road systems to areas with noxious-weed infested areas. MMC would limit brushing and mowing to the minimum distance and height necessary to meet safety objectives in areas of heavy weed infestations.

MMC would pressure wash all off-road equipment including equipment for mining, vegetation clearing, road construction and maintenance, and reclamation before entering the project area to help prevent the introduction of new invader noxious weed species to the area.

MMC would continue to monitor/survey the project area for new invader weed species on a yearly basis. MMC would monitor weed population levels with particular emphasis on haul

routes, access routes, borrow areas, soil stockpiles, and the transmission line corridor. MMC would treat weed infestations as needed.

In areas where timber was to be removed (particularly the transmission line corridor), MMC would consider winter vegetation clearing to reduce mineral soil exposure and the chance of spreading existing noxious weeds.

MMC would implement site-specific guidelines to be followed for weed treatments within or adjacent to known sensitive plant populations. MMC would evaluate all future treatment sites for sensitive plant habitat suitability; suitable habitats would be surveyed as necessary prior to treatment.

## 2.5.6 Operational and Post-Operational Monitoring Programs

Numerous operational and post-operational monitoring programs proposed by MMC are described in Alternative 2. Except as described in the following sections, these programs in Alternative 3 would be the same as Alternative 2. For example, in Alternative 3, MMC would complete a ground water-dependent ecosystem inventory of an area overlying the proposed underground mine. MMC did not propose such an inventory in Alternative 2. The proposed inventory is described below, and is incorporated by reference into Alternative 4. The air quality monitoring program would be the same in Alternative 2 as Alternatives 3 and 4. Therefore, the air quality monitoring program is not discussed in Alternatives 3 or 4.

### 2.5.6.1 Ground Water Dependent Ecosystem Inventory

#### *2.5.6.1.1 Inventory Objectives*

The intent of the monitoring program is to provide long-term monitoring of the water resources and ground water-dependent ecosystems that could be impacted by the mine. Prior to the Libby Adit evaluation program, MMC would complete a comprehensive ground water-dependent ecosystem (GDE) inventory (springs, wetlands, fens, flora, fauna, hyporheic zones, gaining reaches of streams) focusing on areas below about 5,600 feet. The inventory area is shown on Figure 33. A GDE inventory would be needed because a comprehensive inventory of the resources overlying the proposed mine facilities has not been completed. An inventory would help identify and rank GDEs based on their importance in sustaining critical habitats or species and the most important or vulnerable ones would be targeted for monitoring. The inventory would be conducted in accordance with the most current version of the Forest Service's *Ground-Water Resource Inventory and Monitoring Protocol* (USDA Forest Service 2006a).

#### *2.5.6.1.2 Springs Inventory*

The inventory area is shown on Figure 33 would be surveyed for springs. In this initial inventory, the flow of spring would be measured twice, once in early June or when the area was initially accessible, and once between mid-August and mid-September. The most accurate site-specific method for measuring spring flow would be used, which may include the use of a flume, weir, flow meter or timed volumetric measurement. Any spring with a measurable flow between mid-August and mid-September would be assessed for its connection to a regional ground water system, based on flow characteristics (*e.g.*, possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation), water chemistry, and the hydrogeologic setting (*e.g.*, associated geology such as the occurrence or absence of colluvium or alluvium).

#### *2.5.6.1.3 Wetland and Riparian Vegetation Inventory*

The inventory area, shown on Figure 33, would be surveyed for ground water-dependent wetlands, fens, and riparian areas. At each critical GDE habitat identified from the inventory, a vegetation survey would be completed. A botanist/plant ecologist or other qualified individual would design survey methodology and protocols that would be approved by the agencies. Initial survey data would include site photos and points, GPS site locations, basic site descriptors, and plant species composition, focusing on hydrophytes (plants that are able to live either in water itself or in very moist soils).

#### *2.5.6.1.4 Stream Base Flow Inventory*

In the initial inventory, the flow of any stream in the GDE inventory area would be measured when the area was initially accessible, monthly during the summer months and weekly between mid-August and mid-September. The most accurate site-specific method for measuring streamflow would be used, which may include the use of a flume, weir, flow meter, or timed volumetric measurement. Any stream with a measurable flow between mid-August and mid-September would be assessed for its connection to a regional ground water system, based on the associated hydrogeology such as faults or the occurrence or absence of colluvium and/or alluvium and possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation. Gaining stream reaches would be mapped, and then monitoring locations would be refined to focus on gaining reach lengths and flow.

#### *2.5.6.1.5 Lakes Inventory*

Beginning 1 year prior to construction, the levels of Rock Lake, St. Paul Lake, and Lower Libby Lake, which all overlie the proposed mine, would be measured continuously. Each lake would be assessed for its connection to a regional ground water system, based on water balance, the associated hydrogeologic characteristics such as faults or the occurrence or absence of colluvium and/or alluvium and possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation.

### 2.5.6.2 Ground Water Dependent Ecosystem Monitoring

#### *2.5.6.2.1 Monitoring Objectives*

GDE monitoring would have locations and frequency specified based on inventory data and on the local hydrogeology and proximity to the mine or adit void. The objective of GDE monitoring would be to detect changes in ecological integrity of dependent species and habitat. A GDE Monitoring and Mitigation Plan would be developed for important GDEs found during the inventory that would most effectively detect and minimize stress to flora and fauna from surface effects of mine dewatering. The plan would be submitted to the agencies for approval after the GDE inventory is completed and early enough for 1 year of baseline data to be collected before mining begins. The plan would include piezometers in critical locations. The plan would include a monitoring schedule, a mitigation plan, and mitigation implementation triggers. The results of the initial inventory, subsequent inventories, and monitoring would be reported in annual reports to the lead agencies.

There are several criteria required to decide which characteristics to monitor, including traits that: (1) *have a defined relationship with groundwater levels*; there needs to be confidence that a measured response within a parameter reflects altered ground water levels rather than other abiotic/biotic factors; (2) *are logistically practical*; parameters should be practical to measure

within the constraints of a wilderness setting; parameters that reflect landscape responses by GDEs of wide distribution, such as remote sensing of hydrophytic vegetation health, could be considered; (4) *have early warning capabilities*; it is important to consider the 'lag' time between changed ground water levels and environmental condition and/or health. The response of vegetation parameters influenced by changed ground water levels can take a long time to manifest and further reductions may occur before impacts of previous changes are realized; consequently, parameters with rapid responses are favored (*e.g.*, piezometers), as they provide advanced warning of significant stress or degradation on the system, as well as providing the opportunity to determine whether intervention or further investigation is required. Nevertheless, some GDE values may have to be measured through parameters with a greater 'lag' time (*e.g.*, hydrophytic vegetation community composition).

Table 19 identifies the specific monitoring options for surface resources in the area. After the initial survey, the options in the table will help establish the methods that would be used to monitor GDEs.

**Table 19. Ground Water Dependent Ecosystem Inventory and Monitoring, Alternatives 3 and 4.**

| Surface Resource Component | Look For: | Using: |
|---|---|---|
| Springs, Lakes, and Streams | Flow changes | Flow monitoring |
| | Lake level changes | Continuous level recorder |
| | Ground water level changes | Piezometers |
| Wetland and Riparian Vegetation | Ground water level changes | Piezometers |
| | Dieback, early desiccation, habitat decline | Photo points, field surveys, remote sensing |
| | Soil moisture stress | Tensiometers |
| | Plant water potential/turgor pressure changes | Pressure bomb technique |
| Amphibians, Mollusks, Macroinvertebrates, Fish | Population decline, community composition change | Field surveys |
| Terrestrial Animals | Population/usage decline | Field surveys |

### *2.5.6.2.2 Springs Monitoring*

The flow in springs determined to be supported by the regional ground water system or whose connection to the regional ground water system was uncertain would be measured annually between mid-August and mid-September. A spring that was determined, after repeated flow measurements, not to be connected to the regional ground water system may be eliminated from additional monitoring. However, additional monitoring of flow and quality of any spring overlying the proposed mine may be required, depending on the outcome of the GDE inventory. Flow monitoring of springs or streams, by itself, is generally inadequate because mining induced impacts are frequently subtle and hard to distinguish from natural variability. Flow monitoring can only detect relatively large mining induced changes in flow.

### *2.5.6.2.3 Wetland and Riparian Vegetation Monitoring*

Indicator hydrophytes and their distribution and frequency would be chosen from the initial survey information and identified as "trigger plants." Trigger plants would serve as a basic

"trigger" to begin annual monitoring in a particular site. Other monitoring options such as piezometers would be used to facilitate or strengthen monitoring effectiveness. If a change in seep or spring flow, water level, or water quality were noted outside the baseline data for an individual site or set of sites, a re-evaluation of those potentially affected habitats would be conducted and documented for comparison against initial survey information. Depending on a combination of biological or physical variables or the severity of plant indicator decline, the lead agencies may require more rigorous monitoring. Potential monitoring options for wetlands (including fens) and riparian areas are shown in Table 19.

#### 2.5.6.3 Surface and Ground Water

The lead agencies' modified MMC's proposed surface and ground water monitoring plan. The plan is presented in Appendix C.

#### 2.5.6.4 Fisheries and Aquatic Life

The lead agencies' modified MMC's proposed fisheries and aquatic life monitoring plan. The plan is presented in Appendix C.

### 2.5.7 Mitigation Plans

In Alternative 3, the wetlands, fisheries, and wildlife mitigation plans would differ from that proposed in Alternative 2. The proposed plans for these resources are discussed below. The Hard Rock Mining Impact Plan would be the same as Alternative 2.

#### 2.5.7.1 Wetland Mitigation

##### *2.5.7.1.1 Proposed Sites*

In Alternative 2, MMC proposed to mitigate affected forested and herbaceous wetlands at a 2:1 ratio, and herbaceous/shrub wetlands and waters of the U.S. at a 1:1 ratio. MMC's proposed mitigation sites are two sites in the Little Cherry Creek drainage, three sites between Little Cherry and Poorman creeks (in Alternative 3, the Poorman Impoundment Site), one site east of LAD Area 1, and one site at the Libby Creek Recreational Gold Panning Area (Figure 21). In Alternative 3, the three sites between Little Cherry and Poorman creeks and one of the sites at Little Cherry Creek would not be available because they would be within the Poorman Tailings Impoundment Site. MMC's proposed mitigation site at the Libby Creek Recreational Gold Panning Area was not part of Noranda's 1993 Section 404 permit. Because of high public use of the Recreational Gold Panning Area, it would not be used in Alternative 3 or 4.

In Alternative 3, possible wetland mitigation sites would include 2.2 acres at the Little Cherry Creek site, 15.3 acres at the South Little Cherry Creek sites, and 6.7 acres at the Ramsey Creek site (Figure 34). The Corps would be responsible for developing final mitigation ratios for jurisdictional wetlands, depending on the function and values of the affected wetlands. The minimum ratio for wetland restoration (reestablishment and rehabilitation) is 1.5 acres restored to 1 acre impacted; the minimum ratio for establishment is 2 acres established to 1 acre impacted (Corps 2005). Sufficient mitigation sites have been identified to achieve the Corps' minimum ratios. In addition to mitigation for jurisdictional wetlands, MMC would mitigate for non-jurisdictional wetlands at a ratio of 1 acre mitigated to 1 acre impacted. The amount of jurisdictional and non-jurisdictional wetlands affected by the mine alternatives are listed in Table 149.

Wetlands would be developed through excavation of shallow depressions in locations where surface water would collect and be retained. Before final design, shallow piezometers or monitoring wells would be installed in the proposed mitigation sites and 6 months of monthly monitoring (April through September) of water levels to determine ground water levels would be completed. Monitoring data would be submitted with the final wetland mitigation plan. The shallow wells would be used to assess whether ground water would support wetlands if the mitigation sites were excavated to near the ground water surface. Ground water from beneath the tailings impoundment would not be used to provide hydrologic support as proposed in Alternative 2. Where feasible, wetland soil, sod, and shrubs would be excavated from existing wetlands prior to filling during construction, and placed in the wetland mitigation areas.

According to MMC, the Ramsey Creek mitigation site is part of an existing man-made wetland area. The site would be expanded by spreading out streamflow that would provide hydrologic support. MMC would conduct a wetland delineation of the proposed area during final design to ensure the wetland was jurisdictional. The site would be used to mitigate either jurisdictional or non-jurisdictional wetlands, depending on the jurisdictional status of the existing wetland.

#### *2.5.7.1.2 Monitoring of Wetland Mitigation Sites*

Monitoring of wetland mitigation sites would be conducted annually, generally as proposed in Alternative 2, with the following changes. The monitoring described in this section may be modified in a Corps' 404 permit, if issued for the project. If success were not achieved within 5 years, MMC would be required to modify the sites or implement other mitigation plans, both of which would subject to approval by the Corps. Wetland monitoring requirements would be extended if success were not achieved within the 5-year period.

Vegetation data would be collected at established quadrat sampling points along established transects to determine vegetation composition. Transects would be spaced at 100-foot intervals along the length of each wetland mitigation site or adjusted to ensure that each mitigation site is adequately sampled to support wetland determinations that proposed acreage is achieved. There would be a minimum of three sampling stations per transect with 1 quadrat sampling point for herbaceous cover type nested within one 10-foot radius sample plot for woody cover type per sampling station. Vegetation assessments would be accomplished in accordance with Corps-accepted sampling techniques. Photo documentation points would be established for each wetland site. Reports would contain a minimum of two photos per site taken during the growing season.

Hydrology data from shallow ground water wells in each mitigation site would be collected at the normal peak of the hydrograph and/or ground water and in September. Frequency and duration of adequate hydrology would be documented in the monitoring reports. Soils also would be investigated for evidence of hydrologic saturation, such soil color, texture, and mottling.

Wetland mitigation success would be achieved when the mitigation site had more than 60 percent gross vegetative aerial coverage as determined by the average of all quadrat sample plot data. Hydrophytes must comprise a minimum of 90 percent of the dominant species as determined from the average of all data points from all polygons. All wetland data points would be comprised of more than 50 percent hydrophytes that were Montana native species. A weed control plan would be implemented for any site if noxious weed species comprised more than 20 percent of the dominants at any mitigation site.

### 2.5.7.2 Fisheries Mitigation

#### *2.5.7.2.1 Access Road Use*

For the Libby Adit evaluation program, MMC would implement the BMPs shown in Table 20, such as installing, replacing, or upgrading culverts, to bring the proposed access roads (NFS roads #231 and #2316) up to INFS standards. All ditches on NFS roads #231 and #2316 would be cleaned out. In RHCAs, MMC would not sidecast snow or surface materials.

**Table 20. Proposed Road Improvements on NFS roads #231 and #2316.**

| Milepost from Junction with NFS Road #4778 | Required Activity |
|---|---|
| MP 0.05 | Install 24-inch ditch-relief culvert. |
| MP 0.10 | Replace existing 18-inch corrugated metal pipe (CMP) with 24-inch CMP. |
| MP 0.13 | Install 24-inch CMP. Scoured channel enters ditch; no pipe present to allow water to cross road. |
| MP 0.30 | Install surface drainage. Drain to the east side of road. |
| MP 0.40 | Surface drainage needed. Drain to the east. |
| MP 0.50 | Lower existing 18-inch CMP and replace if necessary. |
| MP 0.60 | Clean out existing CMP. |
| MP 0.70 | Replace CMP and armor outlet. |
| MP 0.84 | Replace existing CMP with a 24-inch CMP. |
| MP 0.90 | Provide surface drainage needed; drain to south. |
| MP 0.91 | Repair or replace existing 18-inch CMP inlet. |
| MP 1.03 | Provide road surface drainage. Drain to the south. |
| MP 1.20 | Provide road surface drainage. Drain to the south. |
| MP 1.30 | Armor inlet of existing 24-inch CMP inlet. |
| MP 1.41 | Install 24-inch CMP. Install a drainage ditch on MMC's Libby Adit road on private property. |
| MP 1.43 | Provide road surface drainage. Drain to the south. |

#### *2.5.7.2.2 Bull Trout Critical Habitat*

All action alternatives may reduce the flows in Rock Creek, East Fork Bull River, and Libby Creek. Mitigation of lower flows in Rock Creek and East Fork Bull River would focus on the East Fork Bull River and would consist of two parts: 1) completion of a comprehensive habitat survey and 2) construction of instream habitat structures. MMC would complete a comprehensive aquatic habitat survey from the confluence of the East Fork Bull River and Snake Creek up to the extent of fish habitat in East Fork Bull River (~1.3 miles past the CMW boundary; see Figure 35). MMC also would complete a comprehensive aquatic habitat survey in the reach of Libby Creek bordering MMC land that is downstream of the Little Cherry Creek confluence.

Following completion of the habitat inventories, MMC would prepare a stream improvement plan to increase the productivity and carrying capacity in portions of the streams targeted for mitigation. The plan would apply to the reach between the confluence of the East Fork and the North Fork East Fork Bull Rivers upstream to a location 0.5 mile into the CMW and the reach of Libby Creek downstream of the Little Cherry Creek confluence that borders land owned by MMC. The plan would be designed to meet INFS Riparian Management Objectives, to the extent feasible (Table 21). A component of the plan would be installation and maintenance of instream structures to form pool and deep water habitat, provide cover for subadults, and secure habitat for spawning adults. These would be built and maintained using appropriate-sized rock and large wood according to accepted methodologies. Vegetation removed in the Little Cherry Creek impoundment site could be used to provide large woody debris. Another component of the plan would be grade control structures to improve bedload transport, decrease width to depth ratios, and reduce fine sediment accumulation. These components would be modified as appropriate following the habitat survey.

**Table 21. INFS Riparian Management Objectives and Existing Conditions in Area Streams.**

| Habitat Feature | Interim INFS RMO | Average Existing Condition | | |
|---|---|---|---|---|
| | | Libby Creek | Ramsey Creek | Poorman Creek |
| Pool Frequency (km) | 35/km for 20-ft width | 7 | 32 | 16 |
| Large Pool Frequency (km) | NA | 6 | 6 | 0 |
| Water Temperature | < 15°C adult habitat, < 9°C | No data | 10.2 | 5.4 |
| Large Woody Debris (Forested) | > 32 pieces per km | 23 | 116 | 163 |
| Bank Stability (non-forested) | > 80 percent stable | 100 | 99.3 | 100 |
| Lower Bank Angle (non-forested) | > 75 percent of banks < 90° angle | Unknown | | |
| Width/Depth Ratio | < 10 | 104.7 | 55.6 | 33.3 |

After the agencies' approval, MMC would implement the plan. As-built drawings and reference points would be established for all structures, which would be monitored and maintained for the life of the mine. Fish population monitoring would be conducted for the life of the mine to determine effectiveness of the stream improvement projects. Annual monitoring reports would be submitted to the agencies to document the completion of annual monitoring and mitigation effectiveness.

Structures would be monitored and maintained for the life of the mine. Population monitoring would be conducted for the life of the mine to determine effectiveness of the structures. Annual monitoring reports would be finalized and submitted to the agencies documenting the completion of annual monitoring and overall mitigation effectiveness annually.

##### *2.5.7.2.3 Sediment*

Plant site construction, road reconstruction, and road maintenance would generate sediment into project area streams. Mitigation would consist of a two-step process. MMC would initially identify existing sediment sources in Libby Creek particularly near the plant site and then off-site

in Ramsey, Poorman, or upper Libby creeks. After existing sediment sources were identified, MMC would develop sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sources. The inventory and proposed measures would be submitted to the KNF and FWP for approval prior to implementation.

The numbers of pools within the three reaches described by sites L9, Po1, and Ra2 are considerably lower than expected for streams that size (Figure 35). Mitigation at each site would consist of construction of three grade control structures to facilitate bedload transport and maintain an appropriate channel width. Additional work would include the construction of 15 habitat structures in each stream near the sample sites. The structures would increase the carrying capacity of stream habitat directly and indirectly affected by the construction and operation of the mine. Pools formed by the structures would be in excess of 2 feet deep and provide cover for sub adult rearing habitat as well as providing secure habitat for spawning adults. Existing nearby monitoring sites would be protected and left unchanged.

##### *2.5.7.2.4 Monitoring*

Fish population and comprehensive habitat assessments identifying sediment sources and structure sites would be completed prior to construction. Once completed, monitoring plans for fish populations and structure integrity would be developed and implemented to document mitigation implementation, determine effectiveness, and provide for adaptive management to ensure proposed mitigations are sufficient to minimize and offset effects of mine implementation.

#### 2.5.7.3 Wildlife Mitigation

##### *2.5.7.3.1 Grizzly Bear*

In addition to access changes, MMC has prepared a plan to address wildlife issues related to the program. This plan was approved by the Forest Service. The objective of the plan is to identify wildlife issues, establish company procedures and protocols that address these issues, and develop employee and contractor awareness regarding wildlife issues. MMC would implement the following measures:

- No firearms would be permitted at the project site or along the Libby Creek access road by MMC, their contractors, or any subcontractors traveling to the project site
- Hunting would be prohibited on mine property
- Feeding of animals is prohibited
- Bear-proof garbage cans and/or dumpsters would be used on site, and garbage would be removed in a timely manner to avoid potential wildlife conflicts
- Private vehicles would be restricted from entering mine property
- The project area (private property) also would be fenced to prevent movement of big game animals onto the site

MMC has developed a wildlife awareness program to educate the current employees. MMC would continue to work in coordination with KNF and FWP on these and other similar programs. The following training includes:

- Bear awareness and safety
- Wildlife issues

- Refuse management
- Company policies on wildlife issues, firearms, and other related topics

In Alternative 2, MMC proposed the grizzly bear mitigation plan that was approved in the lead agencies' RODs and incorporated into DEQ Operating Permit #00150 (the "1992 Plan"). A number of roads proposed for access changes in the 1992 Plan are no longer available for mitigation. The lead agencies' mitigation plan would have similar components as the 1992 Plan: measures to reduce mortality risks, improve habitat effectiveness, and for mitigation plan management. The following mitigation plan completely replaces the grizzly bear mitigation plan proposed by MMC. Items in *italics* would be implemented prior to the evaluation phase.

This plan includes requirements for MMC to provide funding for a number of conservation measures that are needed long-term. Should future projects be proposed that have adverse effects on T&E species in the Cabinet-Yaak Ecosystem, funding for some of these measures could be required of the proponents, thus potentially changing the proportional funding required by MMC. Those items are marked with an asterisk **(*)** at the end of the measure description.

**Measures to Reduce Mortality Risks**

**A. To reduce mortality risk (avoid incidental take) to Threatened and Endangered species, MMC would comply with the following, under the direction of the Forest Service:**

1. *Develop a transportation plan designed to minimize mine related vehicular traffic, traveling between U.S. 2 and the mill site, and minimize parking availability at the plant site. Busing employees to the mill site, requirement for managers to car pool, and a supply staging area in Libby to consolidate shipments to the mine site would be a part of the plan. Forest Service approval would be required. The plan would be in place prior to the evaluation phase.*

2. *Not use salt when sanding during winter plowing operations to reduce attracting big game, which can result in vehicles killing them. That in turn could draw lynx and grizzly bears to the road corridor and increase mortality risk.*

3. *Remove vehicular-killed big game animals daily from road rights-of-way within the permit area and along roadways used for access or hauling ore (NFS roads #231, #278, #4781, and #2316 and new roads built for the project). Road-killed animals would be moved at least 50 feet beyond the right-of-way clearing or as far as necessary to be out of sight from the road. During construction and the first 3 years of mill operations, MMC would monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. The numbers of animals killed by vehicle collisions would be reviewed by the KNF, in cooperation with the FWP, and if necessary, mitigation measures would be developed and implemented to reduce mortality risks. MMC also would monitor and report (within 24 hours) all grizzly bear, lynx, wolf, and black bear mortalities within the permit area and along the access roads. If a T&E species mortality occurred, and the grizzly bear specialists or law enforcement officer felt it were necessary to avoid grizzly bear or other T&E species mortality, MMC would be required to haul the road-killed animals to a disposal location approved by FWP.*

4. Fund a local MFWP Habitat Conservation Specialist position to aid in grizzly bear conservation for the life of the mine. This would be a new position stationed in a location that serves Lincoln and Sanders counties. Funding would be provided prior to starting the

construction phase to cover the first 5 years and then in 5-year increments until the mine project was completed, including reclamation. The purpose of the position is to identify, evaluate, prioritize, and conserve wildlife habitats for species affected by development and operation of the Montanore mine, with an emphasis on grizzly bears. The position will work with Lincoln and Sanders counties' planning staff to ensure that county land use decisions consider current wildlife information. The position description and an initial list of work items will be developed jointly by the agencies (including, but not limited to Forest Service, USFWS, and FWP) and MMC representatives. The Forest Service will request review and advice from the USFWS on the position description and list of work items.

5. *Fund a local FWP law enforcement position for the life of the mine. This position may be new or existing and would be determined by FWP and USFWS. Funding to cover the first 5 years would be provided prior to starting the evaluation phase. The position would be stationed in Fisher River side of the ecosystem. The position description and an initial list of work items would be developed by the agencies (Forest Service and FWP) and MMC representatives. The Forest Service would request review and advice from the USFWS on the position description and list of work items.*

6. Prior to the construction phase, MMC would:

    a) In order to proceed with the construction phase, agree to defer the construction phase of the mine until at least six female grizzly bears have been augmented into the Cabinet Mountains portion of the Recovery Zone (south of U.S. 2). Female grizzly bears placed in the Cabinet Mountains on or after 10/01/2005 count toward this requirement. As of November 2008, four female bears have been placed in the Cabinets. Two of these bears were killed in October 2008 (Kasworm 2008).

    b) In coordination the KNF and Montana FWP, fund and/or conduct an enhanced outreach and education program to build support and understanding for the conservation of the Cabinet-Yaak grizzly population. This would involve educational materials, public service announcements, newspaper ads, and billboards supporting grizzly conservation. Examples could be signs at entrance roads to all grizzly habitats on the National Forest, education programs for schools and civic clubs, and offering a reward leading to arrest and conviction of people illegally killing grizzly bears in the Cabinet-Yaak Ecosystem. (*)

    c) Coordinate with the bear specialist to provide funding for bear resistant garbage containers for personal use by all mine employees associated with the evaluation, construction, and operation phases who live in or near grizzly bear habitat. *Thirty-five of these containers would be placed at the Libby Adit prior to the evaluation phase.*

    d) Provide funding for a second bear specialist in Libby for the life of mine, similar to position described in #5 above. This position may be new or existing, and would be determined by FWP and USFWS. Initial funding to cover first 5 years of the position provided prior to construction start-up. (*)

    e) Provide funding for an additional 100 bear-resistant garbage containers plus an additional 20 per year, after the first year of construction phase, for distribution to the community at large by the grizzly bear management specialists.

f) Coordinate with bear specialists, USFWS, and Lincoln County to prioritize and provide funding for fencing and electrification of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem. MMC would provide funding for and work with the USFWS and Lincoln County to make garbage collection site(s) bear resistant prior to start of construction start up. (*)

g) *Fund an initial 10 electric fencing kits for use at bear problem sites that can be installed by FWP bear specialists*, and then 2 replacements per year, for use as needed. (*)

h) *Agree that all mortality reduction measures would be subject to modification based on adaptive management, where new information supports changes. Modifications would be reviewed and approved by the Oversight Committee.*

7. The Forest Service would ensure that the law enforcement and information and education positions (grizzly bear personnel) required in the revised mitigation plan comply with the following:

a) Positions would be located in the Fisher River side of the ecosystem.
b) Grizzly bear personnel would be new or existing positions with FWP as determined by FWP and USFWS.
c) Funding intended for the grizzly bear personnel positions would not be used to support already existing positions with FWP that are not performing duties of a grizzly bear specialist.
d) Duties for the law enforcement position would be designed at a State grade determined by FWP (recommend at least a grade 14) and would be primarily directed at wildlife issues in the Cabinet Mountains portion of the Cabinet-Yaak Ecosystem.
e) Duties for the bear specialist positions would be designed as a grizzly bear management specialist at a State grade determined by FWP (recommend at least a grade 14) and would be specifically tied to bear activities in the Cabinet Mountains portion of the Cabinet-Yaak Ecosystem.
f) Grizzly bear personnel would be fully funded for the life of the mine through the reclamation period and including shut-down periods to provide for long-term consistency, the establishment of relationships with the resident public, familiarity with issues and potential problems in the area, and to address the large number of people who may remain in the area even in the event of temporary mine shut-downs.
g) Grizzly bear personnel would be operational, with all supportive equipment, vehicles and gear, prior to the letter to proceed on the construction phase.
h) Establish and maintain (through coordination with the three grizzly bear personnel: 2 specialists and 1 law enforcement officer) a mandatory reporting system to ensure that MMC and Forest Service employees are required to immediately report any black bear or grizzly bear incidents, observations or mortalities to both grizzly bear personnel to ensure that preemptive management, hazing, or removal of food attractants would occur to avoid risks of habituation, mortality or displacement of grizzly bears. The reporting system also would be coordinated with the FWP grizzly bear management specialist in Libby and would provide a mechanism to collect reliable information from the public on such incidents, although such reporting could not be required.

8. Use bear-resistant containers to hold attractants at all Montanore mine facilities. Remove contents in a timely manner (weekly unless a problem develops or grizzly bear personnel recommend a more frequent schedule). Containers would be in place at each mine facility site prior to starting any work on each site. *One of these containers would be placed at the Libby Adit prior to the evaluation phase.*

9. Avoid the use of clovers or other plants attractive to black or grizzly bears in the seed mix used on open roadways or any facility associated with the Montanore Mine (except as rehabilitation on closed roads or mitigation habitat where attracting bears would be encouraged).

10. *Prohibit employees from carrying firearms within the permit area, except for security officers and other designated personnel. Identify consequences for violations in the an employment contract so employees would be aware of consequences prior to beginning their employment.*

11. *Prohibit employees from feeding wildlife (including dropping food stuffs from lunches, etc.) within the permit area to avoid attracting bears or other wildlife into conflicts with people and encouraging habituation. Identify consequences for violations in an employment contract so employees would be aware of consequences prior to beginning their employment.*

12. Fund the acquisition of bear resistant garbage containers to be placed in all developed campgrounds within Bear Management Units 1, 2, 3, 4, 5, 6, 7, 8, and 9 (pack in/pack out sites would not require garbage containers). The Forest Service would ensure that MMC provide bear resistant garbage receptacles for all Forest Service campgrounds and sites where garbage facilities are normally provided within the Cabinet portion of the Cabinet-Yaak Ecosystem recovery zone (in BMUs 1-9). This includes those in MS-3 habitat, which often serve as the greatest risk to habituate bears and increase risk of bear removal through defense of life or property incidents or management action.(*)

13. *Require mine employees (including all management staff) to attend training related to living and working in grizzly bear habitat prior to starting work and on an annual basis thereafter or as scheduled by the grizzly bear management personnel.*

#### Habitat Effectiveness

Habitat effectiveness is defined as the ability of habitat to support grizzly bears based on habitat productivity and security. Habitat security is reduced by major human activities that may result in the displacement of grizzly bears from otherwise suitable habitat. Habitat effectiveness is described in greater detail in section 3.24, *Wildlife Resources*.

**B. To maintain habitat effectiveness and reduce the likelihood of adverse effects on Threatened and Endangered species, MMC would, under the direction of the Forest Service,**

1. Secure or protect (through conservation easement, road access changes, or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service) from development (including but not limited to housing and motorized access) and use (timber harvest, grazing, and mining) replacement habitat to compensate for acres lost by physical alterations, or acres with reduced habitat availability due to disturbance. Replacement acres for the agencies' alternatives are for physical loss and for disturbance. They would be "in kind" replacement acres. Replacement habitat would be provided using the following

schedule in Table 22. This schedule would have all replacement habitats in place prior to starting mill operations.

**Table 22. Required Replacement Acreage.**

| Alternative | Replacement Acres | | Timing |
|---|---|---|---|
| | Physical Loss† | Disturbance‡ | |
| All agencies' alternatives | | 2,880 | Prior to Evaluation Phase |
| 3 C | 4,022 | 19,338 | Prior to Construction |
| 3 D | 4,025 | 20,045 | Prior to Construction |
| 3 E | 4,026 | 22,300 | Prior to Construction |
| 4 C | 4,494 | 19,647 | Prior to Construction |
| 4 D | 4,497 | 20,354 | Prior to Construction |
| 4 E | 4,498 | 22,609 | Prior to Construction |

†Requires conservation easement or acquisition; mitigation requirement is shown at 2 to 1 ratio
‡May be conservation easement, acquisition, or habitat enhancement; mitigation requirement is shown at 1:1 ratio (see mitigation items B2, C1, and D1 below for planned measures toward meeting this requirement)
§Mitigation required for use of existing roads (about 15 percent of the disturbance replacement acres) would be needed before start of mill operations; replacement habitat for the ventilation adit would be in place prior to its construction, if the adit became necessary.

Either fee title or conservation easements would be acceptable. Conservation easements would be in perpetuity and transferred to the Forest Service. If fee lands were retained in private (not federal ownership) a conservation easement protecting the land in perpetuity must be conveyed to the Forest Service. Fee title lands may be considered for donation or land exchange with the Forest Service. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres would be funded by MMC. Land exchanges would be for equal valued lands as determined by a federal land appraisal. Any exchange must be beneficial to the Forest Service. First choice for replacement habitat would be within the disturbed BMUs (2, 5, and 6). If adequate replacement acres were not available in those BMUs, then lands may be located in other BMUs (1, 4, 7, and 8) within the Cabinet Mountains.

The USFWS would be consulted with and asked advice on the mitigation acres and associated conservation easements as they relate to the requirements included in the Biological Opinion on the Montanore Mine, at an early stage in the acquisition negotiations. Forest Service would have final approval of mitigation acres and associated conservation easements prior to closing and recording.

The Forest Service would ensure that the specified acres (Table 22) of mitigation properties be managed for grizzly bear habitat in perpetuity. Properties acquired in fee by MMC must either be transferred to the Forest Service or must be protected by perpetual conservation easement transferred to the Forest Service. Easement properties acquired by MMC must be transferred to the Forest Service. The specified acres of mitigation properties must meet the following requirements:

a) The USFWS would be requested to advise the Forest Service if it believed the proposed mitigation properties met one or more of the following:

   i restores or improves bear security habitat (HE and core) in the Cabinet Mountains, particularly in the constricted north-south grizzly bear movement corridor;

   ii improves habitat conditions related to established access standards in BMUs 2, 5, and 6;

   iii reduces existing threats of development, food attractants or mortality risks in the Cabinets;

   iv reduces potential threats of development, food attractants or mortality risks in the Cabinets;

   v protect seasonally important habitats, with an primary emphasis on spring, and secondary emphasis on fall habitats; and/or

   vi would maintain or increase MS-1 habitat (including the potential of acquiring and converting MS-3 properties or lands adjacent to the Cabinet-Yaak Ecosystem recovery zone that have high mortality risks to MS-1 if those risks could be eliminated under federal ownership);

b) Fee-title properties or transfers (trades) of National Forest System lands must meet standards, requirements, and legal processes for federal acquisition or trade, including, but not limited to:

   i approval by the Office of General Counsel;

   ii be a Warranty Deed conveyance;

   iii comply with Department of Justice standards;

   iv be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition;

   v include all surface and sub-surface rights including rights-of-ways, mineral claims, and/or other easements, unless otherwise advised by the USFWS;

   vi be acquired in priority order. Lower priority acquisitions may be allowed, after approval of the Forest Service and when consistent with advice from the USFWS to ensure that such a property would contribute to meeting the requirements of the Biological Opinion;

   vii meet fair market appraised value, according to Forest Service appraisal processes with the allowance that MMC could contribute additional funds to facilitate unequal appraised value trades, as approved by the Management Plan. Advanced approval by the Forest Service, after consultation with the USFWS regarding the ability of the proposed lands to meet the requirements of the Biological Opinion, is required; and

   viii be acquired and recorded prior to the letter to proceed on the associated phase of the mine, with total acquisitions completed prior to the letter to proceed on the construction phase of the mine.

c) Conservation easements must include language approved in the Management Plan and meet standards, requirements and legal processes for federal acquisition or trade, including, but not limited to:

   i approval by the Office of General Counsel;

   ii have the conservation easement be attached to the Warranty Deed;

iii comply with Department of Justice standards;

iv be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition;

v Include all surface and sub-surface rights including rights-of-ways, mineral claims, and/or other easements, unless otherwise advised by the USFWS;

vi be acquired in priority order. Lower priority acquisitions may be allowed, when consistent with advice from the USFWS to ensure that such a property would contribute to avoiding jeopardy;

vii meet fair market appraised value, according to Forest Service appraisal processes with the allowance that MMC could contribute additional funds to facilitate unequal appraised value trades, as approved by the Management Plan if the affected parcels were consistent with advice from the USFWS as being important to avoid jeopardy; and

viii be acquired and recorded prior to the letter to proceed on the associated phase of the mine, with all mitigation habitat acquired and recorded prior to the letter to proceed on the construction phase of the mine, excepting the mitigation habitat that may be necessary in the event the ventilation adit is required. Mitigation habitat for the ventilation adit would be acquired prior to the letter to proceed on development of the ventilation adit, should it be necessary.

The Forest Service would implement access management improvements on lands acquired in the revised mitigation plan. The USFWS requires specific mitigation properties to be acquired to improve habitat security; core area; total motorized route density; and open motorized route density and would assess other areas prior to acquisition to ensure these lands would be sufficient to avoid jeopardizing the Cabinet-Yaak Ecosystem grizzly bear population. These specific areas would be withheld from public disclosure due to their sensitive nature until acquisitions have been finalized.

The USFWS agrees to work with the Forest Service in determining how road management associated with that property can improve access standards, with the goal of managing BMUs 2, 5, and 6 above levels identified by research (Wakkinen and Kasworm 1997). The USFWS believes the disturbances as expected with the Montanore Mine necessitate access management at a conservative level while the disturbance is ongoing. The acquisition of mitigation habitat may provide opportunities to manage access management at these levels in BMUs 2, 5, and/or 6. Should mitigation property be acquired that would enable access management at these levels, the USFWS expects that the Forest Service would provide the bears using BMUs 2, 5, and 6 the optimum level of access management to reduce displacement and mortality risks during the life of the mine.

2. Fund habitat enhancement, commensurate with loss of habitat effectiveness (Table 23). Enhancements include, but are not limited to, prescribed fire to restore whitebark pine, road access changes, and obliterations. Enhancements are preferred in the affected BMUs; if opportunities were not available, then enhancement may be done in BMUs in other portions of the Cabinet Mountains. Generally enhancements would occur in relation to replacement habitat acres. Enhancements associated with replacement acres would occur in a timely manner as agreed to by the agencies.

**Table 23. Required Acreage for Reduced Habitat Effectiveness.**

| Mine and Transmission Line Alternative Combination | BMU (#) | H.E. Change (%) | Habitat Effectiveness Mitigation (acres) |
|---|---|---|---|
| 3C | 5 | -6 | 4,481 |
| 3C | 6 | -4 | 2,489 |
| 3D | 5 | -6 | 4,401 |
| 3D | 6 | -5 | 2,757 |
| 3E | 5 | -6 | 4,401 |
| 3E | 6 | -7 | 4,019 |
| 4C | 5 | -6 | 4,361 |
| 4C | 6 | -4 | 2,489 |
| 4D | 5 | -6 | 4,282 |
| 4D | 6 | -5 | 2,756 |
| 4E | 5 | -6 | 4,282 |
| 4E | 6 | -7 | 4,019 |

These acres may also count toward the disturbance mitigation requirement (Table 22).

**C. To reduce mortality risk, maintain habitat effectiveness, reduce incidental take, and avoid jeopardy for Threatened and Endangered species the KNF, with MMC funds, would:**

1. Change the access of the following roads prior to the start of the Libby Adit evaluation program (Table 24) and prior to the start of construction phase (Table 25) (Figure 36); monitor the effectiveness of closure device at least twice annually, and complete any necessary repairs immediately. Roads shown in Table 24 that would be seasonally gated would provide 1,810 acres of spring grizzly bear habitat. The acres of mitigation credit provided by the other road access changes shown in Table 24 and Table 25 would be core acres created following installation of gates, road decommissioning, or long-term storage. For all agencies' alternatives, access changes during the Libby Adit Evaluation Program would create 2,554 acres of core habitat. Road access changes during full project construction and operations would create an additional 2,077 acres of core in Alternatives 3/4 C, and 3,096 acres in Alternatives 3/4 D and E. Total core created would be 4,631 acres in Alternatives 3/4 C, and 5,650 acres in Alternatives 3/4 D and E. Because core habitat provides the highest quality conditions and would be better than the non-core acres affected by the project, mitigation credit is given at 2:1 ratio. Therefore, the 4,631 and 5,650 acres of core created also count as 9,262 and 11,300 acres, respectively, of mitigation toward the disturbance mitigation acre requirement (see Table 22).

2. Implement a mandatory food storage order for BMUs 2, 5, and 6 prior to allowing MMC to start the construction phase, and implement same order throughout the Cabinet-Yaak Ecosystem within 5 years of construction completion.

**Table 24. KNF's Proposed Access Changes for Grizzly Bear Mitigation Prior to Libby Adit Evaluation Program.**

| Road Number | Road Name | Miles | Current Access Status | Proposed Access Status | Period | Notes |
|---|---|---|---|---|---|---|
| 231<br>2316 | Libby Creek Road;<br>Upper Libby Creek | 2.0<br>1.5 | Open | Gated seasonally | April 1 to May 15 | Mine traffic only during closure period |
| 4778<br>4778E<br>5192<br>5192A | Midas-Howard Creek<br>Midas-Howard Creek E<br>Midas Bowl<br>Midas Bowl A | 6.7<br>0.8<br>1.6<br>0.2 | Open | Gated seasonally | April 1 to June 15 | No snow vehicles during closure |
| 4776A<br>4778C | Horse Mtn Lookout A<br>Midas Howard Creek C | 2.7<br>1.9 | Open | Barriered | Year-long | Open to over snow vehicles Dec. 1 to March 31. |
| 4778C | Midas Howard Creek C | 1.5 | Gated | Barriered | Year-long | Open to over snow vehicles Dec. 1 to March 31. |
| 14458 | Midasize | 0.6 | Open | Barriered | Year-long | No snow vehicles |
| 4776C<br>4776F<br>6200<br>6200D<br>6200E<br>6200F<br>6214<br>6214F | Horse Mtn Lookout C<br>Horse Mtn Lookout F<br>Granite-Bear Creek<br>Granite-Bear Creek D<br>Granite-Bear Creek E<br>Granite-Bear Creek F<br>Cable-Poorman Creek<br>Cable-Poorman Creek F | 0.9<br>1.1<br>1.8<br>0.9<br>0.3<br>0.4<br>3.6<br>0.6 | Gated | Barriered | Year-long | Open to over snow vehicles Dec. 1 to March 31. |
| 6745† | Standard Creek | 3.9 | Gated | Barriered | Year-long | KNF would maintain as a trail; no snow vehicles |

†The Standard Creek road #6745 is currently maintained as a trail. Road storage work would maintain this road as a trail while stabilizing the road hydrologically.

**Table 25. KNF's Proposed Road Access Changes for Grizzly Bear Mitigation Prior to Full Project Construction.**

| Road Number | Road Name | Miles | Current Access Status | Proposed Access Status | Period | Notes |
|---|---|---|---|---|---|---|
| 2316<br>6702 | Upper Libby Creek; South Upper Libby Creek | 0.7<br>1.1 | Gated | Barriered | Year-long | Restricted year-long to all motorized vehicles |
| 4781<br>6701 | Ramsey Creek; South Ramsey Creek | 2.8<br>0.4 | Gated | Barriered | Year-long | Restricted year-long to all motorized vehicles |
| 4725† | North Fork Miller Creek | Alt 3/4C<br>2.8<br>Alt 3/4D<br>4.2<br>Alt 3/4 E<br>4.2 | Gated | Barriered | Year-long | Restricted year-long to all motorized vehicles |
| 2317 | Poorman Creek | 1.8 | No restrictions on motorized vehicle use | Barriered | Year-long | Restricted year-long to all motorized vehicles |

†Access on Road 4725 changed following completion of transmission line construction in Alternatives 3C and 4C.

3. In coordination with the FWP and USFWS, the Forest Service would prioritize lands for conservation easement or acquisition in key linkage areas, identified by research and/or monitoring, that extend east between the Cabinet-Yaak Ecosystem and the Northern Continental Divide Ecosystem. Up to one-half of replacement acres for disturbance mitigation may be in this linkage area.

4. The Forest Service would coordinate with the USFWS and FWP on release sites for augmentation of grizzly bears on National Forest System lands.

5. Prior to the start of the construction phase, MMC would provide funding for bear monitoring in the area along U.S. 2 between the Cabinets and the Yaak River and/or the area between the Cabinet-Yaak Ecosystem and Northern Continental Divide Ecosystem as identified by FWP. The linkage identification work along U.S. 2 would involve 3 years of monitoring movements of grizzly and black bears along the highway to identify movement patterns and key movement sites. Funding would cover aerial flights for 2 hours per week, 30 weeks per year for 3 years, salary for one seasonal worker for 6 month per year for 3 years, salary for one GIS technician for 6 months per year for 3 years and 10 GPS collars, and collar rebuilds each year for 3 years. **(*)**

**D. To address habitat constriction that reduces the potential to achieve Cabinet-Yaak Ecosystem grizzly bear recovery goals (by impacting individuals in the Cabinet Mountains) and to avoid jeopardy, MMC would:**

1. Secure or protect (through conservation easement, including motorized route access changes) or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, and mining) about 5 acres near Rock Lake Meadows (T.26N., R.31W. NW ¼ section 6) of replacement habitat that would enhance the north to south habitat corridor in the Cabinet Mountains. These lands are in addition to those identified under mitigation item B-1. All acres of replacement habitat for the constriction impact would be secured prior to starting the construction phase. These lands would be placed in public ownership either through donation or land exchange. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres would be funded by MMC. All land interest conveyed to the Forest Service must be acceptable and approved by the Office of General Counsel. Fee title land must be conveyed by Warranty Deed in accordance with Department of Justice standards. All property or interest in property, would be inspected for hazardous substances in accordance with law, regulation, and policy. If hazardous substances were found, an agreement needs to be reached on removal and remedial action. The property is located in the East Fork Rock Creek drainage and is accessed by motorized trail #935.

   MMC would provide funding for the Forest Service to create core habitat for grizzly bear along trail #935 (Figure 36). This would include but is not limited to: removal of motorized vehicle bridges, replacement foot traffic bridges, replacing gate at trailhead with a barrier, and conversion of motorized trail tread to foot traffic tread conditions. This measure provides 1,220 acres of core habitat. Because the created habitat would be core habitat, these acres would count as 2,440 acres of mitigation toward the disturbance mitigation requirement shown in Table 22.

The Forest Service would ensure that, for the 5 acres of mitigation habitat required to enhance the north-south corridor in the Cabinet Mountains:

a) the fee title or perpetual conservation easement to the 5 acres of mitigation property, be acquired by or transferred to the Forest Service;
b) include the specific properties identified by the USFWS to avoid jeopardy (which would be released to the public when acquisition has been completed and recorded);
c) the Forest Service would request that the USFWS advise the agency as to whether the proposed acres meet the requirements of the Biological Opinion, and once confirmed, would be acquired and recorded prior to the letter to proceed on the construction phase;
d) be managed as grizzly bear security habitat (core) throughout the life of the mine, including the reclamation period and any temporary or extended shutdown periods, and thereafter managed in a manner consistent with grizzly bear conservation requirements;
e) maintain or improve existing baseline core conditions; and
f) have any habitat enhancement activities needed to improve the mitigation properties, such as the trail conversion, be planned and funded prior to the letter to proceed on the associated phase of the mine. Implementation would occur as soon as feasible (*e.g.*, upon completion of any required NEPA process).

**E. To assure compliance with the T&E species mitigation plan, and effectiveness of the management plan, the Forest Service or MMC would:**

1. Prior to the construction phase,

   a) MMC would establish a trust fund and/or post a bond, to cover the mitigation plan implementation costs. The amount in the fund or posted in a bond would be commensurate with projected work and associated required mitigation items. The Oversight Committee would determine the amount of trust fund deposits, to be made in 5-year increments over the life of the mine.

   b) Forest Service would lead a stakeholders information annual meeting. Stakeholders may include, but not limited to state and federal agencies, county commissioners, mining company, local citizen, and non-governmental organizations representatives. The objectives of the meetings are to review a) management objectives, b) implementation of mitigation measures, and c) monitoring and research results.

   c) Forest Service would agree to adopt management actions in response to new information from monitoring to assure that on going management meets the objectives for grizzly bears in the Cabinet-Yaak Ecosystem.

2. Participate in the development of and be a signer on a Memorandum of Understanding (MOU):

   The Forest Service would develop an MOU with FWP, MMC, and other parties deemed appropriate by the Forest Service. The MOU must be completed prior to the Forest Service issuing MMC the letter to proceed with the construction phase. The MOU would establish roles, responsibilities, and time lines of an Oversight Committee comprised of members of the Forest Service, FWP, and other parties deemed appropriate by the parties named. The

USFWS would be an ex-officio, non-voting member of the Oversight Committee, with only advisory responsibilities.

The Oversight Committee would be responsible for the development of a Comprehensive Grizzly Bear Management Plan and its implementation. The Comprehensive Grizzly Bear Management Plan would focus on the Cabinet portion of the Cabinet-Yaak Ecosystem and would fully include all provisions of the Forest's mitigation plan for grizzly bears, except where superseded by the USFWS' Biological Opinion. It also would include provisions for adaptive management. The plan would be developed in detail by the parties to assure that human access to grizzly bear habitat, grizzly bear habitat quality, grizzly bear mortality, and habitat fragmentation issues would be addressed to the extent that jeopardy would be avoided. Advice and comments on the plan from the USFWS would be requested and fully considered, including advice on whether the plan would meet the requirements of the Biological Opinion.

The Oversight Committee, led by the Forest Service, would over the life of the mine:

a) assume responsibility for coordinating various aspects of the Management Plan;
b) assume responsibility for maintaining effective communication among all Committee members, stake holders, and interested public; and
c) integrate the principles of adaptive management; collect, disseminate where needed, and review new information on grizzly bears; the results of implementation of the Comprehensive Grizzly Bear Management Plan over time; and other information related to Cabinet-Yaak Ecosystem grizzly bears. Based on new information, if appropriate to ensure the proposed action is not likely to jeopardize the Cabinet-Yaak Ecosystem grizzly bear population, conduct additional analyses or develop recommendations for modifications of the mitigation plan to be implemented during the life of the mine. The USFWS would be asked to review proposed revisions to the Comprehensive Grizzly Bear Management Plan under appropriate section 7 provisions, if required.

The USFWS would be an advisor in the development of the MOU and subsequent Comprehensive Grizzly Bear Management Plan, and the Forest Service would request that the USFWS advise, in writing, that the plan would meet the requirements of the Biological Opinion.

The MOU would be completed prior to proceeding on the construction phase and require the Forest Service to:

1. Ensure the Management Plan is completed prior to the construction phase of the mine.
2. Establish time frames for mitigation and implementation of other management to occur prior to the letter to proceed on the phase of the mine associated with that mitigation or management activity.
3. Ensure adequate funding, from MMC, to implement the mitigation plan according to the time frames.
4. Comply with legal guidelines or processes in as timely manner as possible in order to meet the mitigation plan and/or Comprehensive Grizzly Bear Management Plan implementation schedule.

5. Ensure that the USFWS is consulted on the mitigation properties and the Comprehensive Grizzly Bear Management Plan and the USFWS is requested to advise the Forest Service if the properties and the Plan meet the requirements in the Biological Opinion. All mitigation properties not specifically mentioned would have undergone all necessary procedures for procurement including recordation, prior to the agencies' letter to proceed on the associated phase of the mine.

6. Establish language and legal procedures to ensure that mitigation properties acquired through fee title, land transfer, or conservation easement:

   a) would be perpetual;
   b) would meet federal policies and regulations regarding such realty actions;
   c) have the USFWS advise whether they would meet the Biological Opinion requirements;
   d) would be implemented and recorded in advance of the phase of the mine with which they are associated;
   e) would increase or at least maintain a no net loss of MS-1 Cabinet-Yaak Ecosystem habitat;
   f) would be adequately funded such that enforcement of easement terms is assured;
   g) would be selected on a priority basis with biologically justifiable rationale and the USFWS advice that they meet the requirements included in the Biological Opinion; and
   h) would ensure management in support of grizzly bear survival and recovery if in public ownership.

The Comprehensive Grizzly Bear Management Plan would include the measures in the mitigation plan, except where the mitigation plan has been superseded by the USFWS' Biological Opinion. In addition, processes would be established to ensure that access management, prevention of habituation, educational opportunities, reporting and monitoring, enforcement of easements, and management actions are being adequately implemented. Further, the Comprehensive Grizzly Bear Management Plan would establish processes to revise management, access, education, or habitat enhancement strategies as new research or policies, such as revised IGBC guidelines.

3. Contribute funding to support monitoring of bear movements and population status in the Cabinet Mountains to confirm the effectiveness of mitigation measures implemented to provide a secure north to south movement corridor. The Forest Service would ensure that adequate funding, provided by MMC, is available to monitor bear movements and use of the Cabinet Mountains to confirm the effective implementation of mitigation measures. Information gained would be useful in determining whether the mitigation plan is working as intended. If not, the information would help in developing new management strategies that would be incorporated in the Biological Opinion through appropriate amendments. Funding would supplement ongoing research and monitoring activities in the Cabinet-Yaak Ecosystem, would be conducted or coordinated by the USFWS' grizzly bear researcher in Libby or the equivalent, and would focus on grizzly bears in the Cabinet Mountains. Funding would include money for the following (but not limited to): trapping, hair sampling and analysis, radio collars, flight time, monitoring native and augmented grizzly bears, and data analysis, including all equipment and support materials needed for such monitoring. The

Forest Service would ensure that funding, provided by MMC, is available on an annual basis, 2 months in advance of the fiscal year (October) of the year it is to be used for the life of the mine. Details of the monitoring activities and budget would be outlined in the Management Plan. Funding would be provided prior to starting the construction phase and would continue throughout the life of the mine through the reclamation phase. (*)

#### *2.5.7.3.2 Key Habitats*

Mitigation common to both the mine and transmission line alternatives is discussed in the following sections. Wildlife mitigation specific to the transmission line is discussed in section 2.9.4, *Wildlife Mitigation Measures*.

**Old Growth**

The KNF would designate effective or replacement old growth on National Forest System lands within the affected PSUs (first priority) or adjacent PSUs (second priority) at a 2:1 ratio for old growth within the disturbance area of the mine Alternatives 3 or 4, or the clearing width of transmission line Alternatives C, D or E (Table 26). Similarly, the KNF would designate effective or replacement old growth on National Forest System lands at a 1:1 ratio for old growth affected by "edge effect" or designated old growth within areas newly designated MA 31 not already accounted for by edge effect (see section 2.12, *Forest Plan Amendment*). Specifically, this would consist of old growth between the proposed mine facilities disturbance and permit area boundaries. Any private land acquisition for grizzly bear habitat mitigation could also be used to offset habitat loss, if old growth habitat characteristics were present on the acquired parcels.

**Table 26. Old Growth Designation Requirements by Mine and Transmission Line Alternative Combination.**

| Old Growth Impact | Combined Alternative | | | | | |
|---|---|---|---|---|---|---|
| | 3C | 3D | 3E | 4C | 4D | 4E |
| Physical Acres† | 382 | 392 | 392 | 366 | 376 | 376 |
| Edge Acres | 190 | 205 | 205 | 150 | 165 | 165 |
| Acres Changed to MA 31‡ | 54 | 54 | 54 | 182 | 182 | 182 |
| Total Designation | 626 | 651 | 651 | 698 | 723 | 723 |

†Physical acres shown equals twice the acres that would be removed.
‡Designated old growth reallocated to MA31 but not included in disturbance area or edge effect. No physical changes would occur to old growth in these areas.

MMC would be restricted in timing of removal of old growth habitat (effective or replacement). No vegetation clearing requiring tree removal would occur between April 1 and July 15 to avoid direct mortality to active nest sites for bird species using old growth habitat, such as pileated woodpecker. This restriction would be incorporated into the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*).

**Snags (Cavity Habitat)**

MME would leave snags within the disturbance area of the mine Alternatives 3 or 4, or the clearing width of transmission line Alternative C, D, or E, unless required to be removed for safety or operational reasons. For example, snags would be left in the LAD Areas where selective

tree thinning would be required. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan, section 2.5.3.2.1, *Vegetation Removal and Disposition.*

#### *2.5.7.3.3 Indicator Species*

**Big Game**

The KNF would change the access of the following roads year-long by earthen barrier to mitigate for the loss of big game security (Figure 36). The roads would be either placed in intermittent stored status or decommissioned.

- Road 4776B Horse Mountain (2.8 miles)
- Road 6209E Crazyman Creek (1.1 miles)
- Road 14442 Lampton Pond (0.6 mile)

The KNF also would mitigate for the loss of big game security by gating and changing the access year-long the roads listed below (Figure 36).

- Road 6205D Big Hoodoo (4.0 miles)
- Road 6787B Hoodoo Bear (1.6 miles)

**Mountain Goat**

MMC would fund surveys to monitor mountain goats to examine response to mine-related impacts. The surveys would be integrated into the current monitoring effort of the FWP. Aerial surveys would be conducted three times annually (winter-late spring-fall) by the FWP along the east front of the Cabinet Mountains from the Bear Creek drainage south to the West Fisher drainage. Surveys would be conducted for 2 consecutive years prior to construction, and every year during construction activities. Survey results would be analyzed by the KNF, in cooperation with the FWP, at the end of the construction period to determine the appropriate level and type of survey work needed during the operations phase. If the agencies determined that construction disturbance were significantly impacting goat populations, mitigation measures would be developed and implemented to reduce the impacts of mine disturbance. Surveys would be conducted using the current protocol of the FWP. Currently, the FWP conducts one aerial survey of the east Cabinet Mountains every other year. This additional level of monitoring would provide information on the status of mountain goat use adjacent to the project area, and potential effects of the project.

MMC would not conduct any blasting at the entrance to any adit portals during June 1 to June 30 to avoid disturbance to the potential goat kidding area on Shaw Mountain.

**Forest Sensitive Birds and State Bird Species of Concern**

MMC would implement the following measures to reduce the effects on Forest sensitive species and State species of concern, such as the flammulated owl, black-backed woodpecker, and northern goshawk. One of two options would be used in migratory bird habitat prior to vegetation clearing. In Option 1, MMC would not remove vegetation in the nesting season to avoid direct mortality at active nest sites. In Option 2, MMC would complete surveys to locate active nests in appropriate habitat. Surveys would be conducted one nesting season before construction activities on National Forest System lands. These measures could also be applied to private land to satisfy the requirements of the MFSA to minimize adverse environmental impacts. If an active nest were

found, an area surrounding the nest would be delineated and not disturbed until after the young fledged. Survey protocols and avoidance areas for specific species are described in Table 27.

**Table 27. Forest Sensitive Birds and State Bird Species of Concern Survey Protocols, Alternatives 3, 4, C, D, and E.**

| Species | Avoidance Period (Option 1) | Option 2 | | |
|---|---|---|---|---|
| | | Survey Period | Protocol Reference | Avoidance Area[†] (acres) |
| Flammulated Owl | May 15 to July 15 | May 15 to July 15 | Bull *et al.* (1990) | 40 |
| Black-backed Woodpecker | April 15 to July 15 | April 15 to July 15 | Bull *et al.* (1990) | 175 |
| Northern Goshawk | May 15 to July 15 | May 15 to July 15 | USDA Forest Service (2005a) | 500-600 |

[†]For flammulated owl, based on Hayward and Verner 1994; for black-backed woodpecker, based on Cherry 1997; for northern goshawk, based on Reynolds *et al.* 1992.

#### Migratory Birds

MMC would either fund or conduct monitoring of landbird populations annually on two, standard Region One monitoring transects within the Crazy and Silverfish PSUs. The Poorman Transect (480-811-533) is located adjacent (slightly northwest) of the LAD Area 1, and the Miller Creek Transect (480-411-527) is located slightly southeast of transmission line Alternative D. Currently, the KNF conducts monitoring every other year on these two transects as part of the Region One Landbird Monitoring Program. Monitoring has been conducted since 1994, and would be continued using the standard Region One Landbird Monitoring Protocol (USDA Forest Service 1998b). This effort could be integrated into the current Region One monitoring program, or could be contracted by MMC. This monitoring effort would continue to provide data on bird species composition along with population trend data in the two PSUs where project activities are proposed.

Migratory songbirds would be monitored in the LAD Areas in Alternatives 3 or 4 to examine mine-related impacts to breeding birds within the treatment areas. MMC would fund the required monitoring work. Monitoring would be conducted for 2 consecutive years (to establish baseline data) prior to construction, every year during LAD site construction activities, and for the first 5 years of the operation period. Monitoring results would be analyzed at the end of this period to determine the appropriate level of monitoring work needed (if any) during the remainder of the operations phase. Monitoring would be conducted using the standard Region One Landbird Monitoring Protocol (USDA Forest Service 1998b).

### 2.5.7.4 Cultural Resource Mitigation

All mine and transmission line alternatives would require additional cultural resource inventory to satisfy requirements of Section 106 under the NHPA and 22-3, MCA. Additional survey would be conducted in all previously undisturbed areas where surface disturbance would occur in the alternative selected in the ROD. Such areas would include any surface disturbance required in mitigation plans described in Alternatives 3 or 4, such as instream structures for fisheries mitigation. The number of cultural resources that would require mitigation may increase pending

the result of these additional inventory efforts. The appropriate type of mitigation would depend on the nature of the cultural resource involved and would ultimately be determined during consultation between MMC, the KNF, and Montana SHPO. Any mitigation plan would be developed by MMC and approved by both the KNF and the Montana SHPO under a memorandum of agreement (MOA), and would include consulting Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho if affected cultural resources were prehistoric or of recent cultural significance.

Mitigation could include data recovery (excavation) of prehistoric archaeological sites, a Historic American Building Survey (HABS) for standing structures, or Historic American Engineering Record (HAER) for built resources such as mines, roads, and trails. For landscape-level resources such as the Libby Mining District, the USDI National Park Service's (NPS) Cultural Landscapes Program would be implemented. Mitigation also would include monitoring during ground disturbing activities when the subsurface spatial extent of the resource is unknown or because of the fragility of the resource and its proximity to the activity. Section 3.7.5, *Mitigation* discusses mitigation measures for known resources in the analysis area.

## 2.6 Alternative 4—Agency Mitigated Little Cherry Creek Impoundment Alternative

### 2.6.1 Issues Addressed

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed permit and disturbance areas at the LAD Areas, as in Alternative 3 (Figure 37). In addition to these modifications from Alternative 3, MMC would modify the proposed Little Cherry Creek Tailings Impoundment Site disturbance areas to avoid RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage. Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint, and to minimize disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6). Waste rock would be stored temporarily within the impoundment footprint to address acid rock drainage and metal leaching (Issue 1) and water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified to adequately convey anticipated flows. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The issues addressed by the modifications and mitigation measures are summarized in Table 28. The modifications and proposed mitigations that comprise Alternative 4 are described in the following sections. All other aspects of MMC's mine proposal would remain as described in Alternative 2. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

**Table 28. Response of Alternative 4 Modifications and Mitigations to Issues.**

| Key Issue | Mine Plan | Tailings Storage | Water Use and Manage-ment | Reclamation | Monitoring and Mitigation Plans |
|---|---|---|---|---|---|
| Issue 1-Acid Rock Drainage and Metal Leaching | ✓ | | ✓ | | |
| Issue 2-Water Quality and Quantity | ✓ | ✓ | ✓ | ✓ | ✓ |
| Issue 3-Aquatic Life | ✓ | ✓ | ✓ | | ✓ |
| Issue 4-Visual Resources | ✓ | ✓ | | ✓ | |
| Issue 5-Threatened or Endangered Species | ✓ | ✓ | | ✓ | ✓ |
| Issue 6-Wildlife | ✓ | ✓ | | ✓ | ✓ |
| Issue 7-Wetlands and Non-wetland Waters of the U.S. | ✓ | | | ✓ | ✓ |

### 2.6.2 Construction Phase

MMC would modify the proposed permit and disturbance areas to avoid RHCAs and old growth in the Little Cherry Creek drainage. Changes to MMC's proposed construction methods, such as soil handling, described for Alternative 3, would be implemented in Alternative 4. Other modifications specific to Alternative 4 are described in the following sections. As in Alternative 3, MMC would submit a final Plan of Operations after final design, including all monitoring and mitigation plans, to the KNF for approval. MMC would submit a final application for a modification of Operating Permit #00150, including all monitoring and mitigation plans, to the DEQ for approval.

#### 2.6.2.1 Permit and Disturbance Areas

All permitted disturbance area boundaries would be marked in the field with fence posts and signed to limit potential disturbance outside permitted disturbance areas. Permit areas would total 3,245 acres and the total disturbance area would be 2,254 acres (Table 29).

#### 2.6.2.2 Modified Little Cherry Creek Tailings Impoundment

MMC would modify the proposed permit and disturbance areas to avoid old growth, core grizzly bear habitat, and RHCAs in the Little Cherry Creek drainage (Figure 22). To the extent feasible, MMC would maximize borrow areas within the footprint of the Little Cherry Creek tailings impoundment footprint to avoid impacts to old growth in Borrow Areas B and C. Acceptable borrow on either side of Little Cherry Creek more than 200 feet from the upstream dam face would be used in Borrow Areas A and B. If suitable borrow were not available within the footprint of the impoundment, MMC would use Borrow Areas C and E, in that order. MMC would locate Borrow Area D south of the Little Cherry Creek impoundment between NFS roads

#278 and #6212 to avoid core grizzly bear habitat (Figure 22). As in Alternative 3, unsuitable materials would be stockpiled and backfilled into borrow areas outside the impoundment footprint in borrow areas C and E. Waste rock would be managed in the same manner as Alternative 3.

**Table 29. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 4.**

| Facility | Disturbance Area (acres) | Permit Area (acres) |
|---|---|---|
| Existing Libby Adit | 22 | 219 |
| Upper Libby Adit | 1 | 1 |
| Rock Lake Ventilation Adit | 1 | 1 |
| Libby Plant Site and Adits | **110** | **172** |
| Modified Little Cherry Creek Tailings Impoundment | **1,602** | **2,191** |
| Little Cherry Creek Impoundment and Seepage Collection Pond | 628 | |
| Borrow areas outside impoundment footprint | **252** | |
| Soil stockpiles | 53 | |
| Other potential disturbance (Diversion Channel, roads, storage areas) | **669** | |
| LAD Area 1 | **260** | **277** |
| LAD Area 2 | **123** | **196** |
| Access Roads† | | |
| Bear Creek Road (NFS road #278 from U.S. 2 to Tailings Impoundment) | **79** | **10** |
| Tailings Impoundment to LAD Areas 1 and 2 (NFS roads 2317 and #4781 and new road to NFS road #278) | **30** | **97** |
| LAD Area to Libby Plant (NFS road #4781 and #6210) | **17** | **70** |
| Libby Plant Site to Libby Adit Site and Upper Libby Adit Site (NFS roads #6210 and #2316) | **9** | **11** |
| Total | **2,254** | **3,245** |

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.
**Bolded** values differ from Alternative 2.

Noranda conducted geotechnical investigations at the Little Cherry Creek Impoundment Site between 1988 and 1990. Noranda reported that bedrock is exposed in the Little Cherry Creek channel and bedrock extended 800 feet downstream of the proposed Seepage Collection Dam (Morrison-Knudsen Engineers, Inc. 1990). Ground water modeling conducted of the Little Cherry Creek Impoundment Site by MMC (Klohn Crippen 2005) and independently verified by the lead agencies (USDA Forest Service 2008a) assumed that the fractured bedrock strata in the Little Cherry Creek drainage is the primary aquifer for ground water flow at the site. In Alternative 4,

MMC would conduct additional geotechnical work near the Seepage Collection Dam during final design and site the dam lower in the drainage if technically feasible.

In Alternative 4, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed diversion channel during final design, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. The channel would begin at the outlet of the engineered channel and would be designed to have the following characteristics:

- A constructed floodplain and terrace that would allow passage of the 100-year flow volume
- A stream portion of the diversion corridor constructed to meet the 2-year flow event volume and approximate the cross-section, profile, and channel materials of similar sized watersheds found in the project area
- Establishment of fish habitat similar to that currently provided by Little Cherry Creek to the extent feasible with the anticipated lower flows

Several mitigation measures would be implemented along the channel to ensure that erosion and sedimentation resulting from heavy rainfall and from high flow events would be minimized. These measures would include:

- The channel and floodplain would be constructed during low flow periods in late summer or early fall
- Floodplain and channel banks would be seeded with an agencies-approved seed mix immediately following construction
- A temporary biodegradable erosion control fabric would be installed along the channel banks, where needed, and on the floodplain immediately following seeding
- Structures of natural materials, which could include boulders or rock/log weirs or vanes, may be installed to protect stream banks where needed
- Alders would be planted along the channel banks at and above bankfull elevation following placement of the erosion control fabric at a density similar to what is currently present along Little Cherry Creek
- Coarse woody debris would be placed along the channel banks to increase surface roughness to reduce flow velocities

Flow in the diversion channels would increase substantially during two periods, one during the construction period after the Diversion Dam was constructed and flow from upper Little Cherry Creek was diverted into the channel, and one after closure when runoff from the impoundment surface and South Saddle Dam flowed into the channel. MMC would complete habitat surveys in the diverted Little Cherry Creek every 2 years until the reclamation bond had been released. The survey would document distance, elevation, macrohabitat type, pool dimensions, large woody debris, substrate, valley slope and width, and riparian characteristics continuously along the entire length of the creek.

The agencies anticipate the channel would require long-term maintenance; MMC would fund a long-term maintenance account to pay for such maintenance. The decision regarding long-term maintenance funded would be made following closure and prior to bond release, after runoff from

the tailings impoundment flowed into the diversion channel. In Alternative 4, soil would be salvaged in two lifts at the Little Cherry Creek Diversion Channel. Soils salvaged from the Diversion Channel would be used as replaced soil on the created floodplain and stream banks of the lower diversion channels and possibly at other disturbances.

In Alternative 2, MMC would build temporary diversion ditches to control run-on within the impoundment site to minimize run-on into the tailings impoundment after Year 2 of operations. As the impoundment filled, new ditches would be excavated farther uphill. Because of the difficulty in routing the run-on into the Little Cherry Creek Diversion Channel, MMC in Alternative 4 would build a permanent diversion ditch between the North Saddle Dam and the Little Cherry Creek Diversion Channel, directing flow either into the Diversion Channel, or Bear Creek (Figure 38). The ditch would be integrated into the surface water management plan of the tailings impoundment at final closure.

The tailings facility design would be finalized as additional site information is obtained during the final design process. In final design, guidelines from the Idaho Administrative Code Safety of Dam Rules (IDAPA 37.03.06, Rule 40.14.d.i]), and the California Department of Water Resources Division of Safety of Dams guidelines for seismic stability would be included in the design criteria for the tailings impoundment. Technical review of the final design would be the same as Alternative 3.

## 2.6.3 Operations Phase

### 2.6.3.1 Water Use and Management

#### *2.6.3.1.1 Project Water Requirements*

The water balance in Alternative 4 would have the same components as MMC's projected water balance in Alternative 2. If the steady-state inflows were 450 gpm as predicted by the ground water model, MMC would need additional water for the mill. The make-up water well field would be in the tailings impoundment area, along NFS road #1408 west of Libby Creek (Figure 38). The limitations on make-up water withdrawals would be the same as Alternative 3. Discharges of up to 198 gpm at the LAD Areas were used for purposes of analysis; discharge volumes may vary and would be based on compliance with water quality standards. Based on the lead agencies' analysis, MMC should have adequate capacity to manage excess water volumes at the existing Libby Adit Water Treatment Plant and outfalls or at the two LAD Areas. If additional capacity were needed, MMC would implement the measures discussed in Alternative 2 to reduce inflows or manage excess water.

#### *2.6.3.1.2 Wastewater Discharges*

In Alternative 4, MMC would maintain the three outfalls at the Libby Adit Site and would seek authorization for additional outfalls. Potential discharges associated with Alternative 4 would be the same as Alternative 2 at the Little Cherry Creek Tailings Impoundment (Figure 15) and the same as Alternative 3 at the LAD Areas 1 and 2 (Figure 28). Potential discharges associated with Alternative 4 include:

- Seepage or percolation to ground water beneath LAD Areas 1 and 2
- Surface water runoff from LAD Areas 1 and 2

- Seepage or percolation to ground water beneath the Little Cherry Creek Tailings Impoundment

### 2.6.3.2 Transportation and Access

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278) and each proposed permit area. With the exception of the Bear Creek Road in the impoundment permit area, all open roads would be gated and limited to mine traffic only. Non-motorized public access would be restricted within each permit area by signage at the permit area boundary. Table 30 lists those roads with a change in road status in Alternative 4; these roads are shown on Figure 39.

#### *2.6.3.2.1 Bear Creek Road (NFS Road #278)*

In Alternative 4, MMC would use the same roads as Alternative 2 for main access during the Libby Adit evaluation program and during operations. MMC would plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. Other mitigation measures described in Alternative 3 would be implemented.

Reconstruction of the Bear Creek Road (NFS road #278), from U.S. 2 to the Bear Creek bridge, Bear Creek bridge replacement, and culvert replacement on NFS road #231 (Libby Creek Road) would be the same as Alternative 3. The public and mine haul traffic would use a segment of the Bear Creek Road from the tailings impoundment permit boundary to the Libby Plant Site Access Road. Because of the joint use, the road would be widened to accommodate haul truck traffic and another lane of public traffic. The joint-use road segments would be widened to widths recommended by the Mine Safety and Health Administration (Mine Safety and Health Administration 1999). For a 16-foot wide haul vehicle, the road width would be 56 feet wide.

MMC would surface the existing Bear Creek Road (NFS road #278) from the new Libby Plant Access Road to the Libby Creek Road (NFS road #231) with 6 inches of gravel 16 feet wide (Figure 39). This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

#### *2.6.3.2.2 Little Cherry Creek Tailings Impoundment Area*

Road use and access in the tailings impoundment area in Alternative 4 would be very similar to Alternative 2. All roads in the operating permit area would be closed to all public access. Little Cherry Loop Road (NFS road #6212) would be gated during operations and used for mine traffic only (Figure 39). The gates would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. NFS road #6212 would remain open to motorized access south of the proposed permit area boundary to the junction with Bear Creek Road. At the end of operations, gates on these roads would be removed and would be reopened to motorized access. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road. With the exception the Cherry Ridge Road (NFS road #6201), other currently gated or barriered roads proposed for use in Alternative 2 in the tailings impoundment area would be used in Alternative 4.

**Table 30. Proposed Change in Road Status, Alternative 4.**

| Road # | Road Name | Location | Existing Status | Length (miles) | Proposed Status |
|---|---|---|---|---|---|
| 2317B | Poorman Creek B | LAD Area 2 | No closure order, impassable | 0.8 | Gated, mine traffic only |
| 278X | Bear Creek X | LAD Area 2 | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 1.0 | Gated, mine traffic only |
| 4781 | Ramsey Creek | LAD Area 2 | Open | 0.3 | Barriered year-long to motor vehicles |
| 4781 | Ramsey Creek | LAD Area 1 up Ramsey Creek | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 3.2 | Barriered year-long to motor vehicles |
| 5170 | Poorman Creek Unit | LAD Area 2 | Open | 0.2 | Gated, mine traffic only |
| 5186 | Ramsey Creek Bottom | LAD Area 2 | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.5 | Gated, mine traffic only |
| 14403 | Lower Ramsey | Libby Plant Site | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Gated, mine traffic only |
| 1408 | Libby Creek Bottom | Tailings Impoundment | No closure order, impassable | 0.5 | Gated, mine traffic only |
| 5181A | Little Cherry Loop H Cowpath A | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.2 | Barriered |
| 5182 | Little Cherry Bear Creek | Tailings Impoundment | Open | 1.6 | Gated, mine traffic only |
| 5183 | Little Cherry View | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.5 | Gated, mine traffic only |
| 6212 | Little Cherry Loop | Tailings Impoundment | Open | 1.1 | Gated, mine traffic only |
| 6212H | Little Cherry Loop H | Tailings Impoundment | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Barriered |
| 6701 | South Ramsey Creek | Upper Ramsey Creek | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.4 | Barriered year-long to motor vehicles |
| 8838 | Little Cherry MS 10377 8838 | Tailings Impoundment | Open | 0.2 | Gated, mine traffic only |

#### *2.6.3.2.3 LAD Areas 1 and 2, Libby Plant Site, Libby Adit, and Upper Libby Adit*

Access and road use in the LAD Areas, Libby Plant Site, Libby Adit, and Upper Libby Adit in Alternative 4 would be the same as Alternative 3 (Figure 39 and Table 30). A segment of NFS road #4781 east of LAD Area 1 and NFS road #2316 near the Libby Adit Site would be widened to 56 feet to accommodate public/mine haul traffic.

#### *2.6.3.2.4 Ramsey Creek Drainage*

Access and road use on NFS road #4781 up Ramsey Creek and NFS road #6701 would change from gated to barriered to provide grizzly bear mitigation.

## 2.6.4 Reclamation Phase

### 2.6.4.1 Post-Mining Topography of Project Facilities

Short- and long-term reclamation objectives would remain the same as for Alternative 2. These objectives would be achieved through interim and final reclamation of all disturbed sites as described for Alternative 2, with additional mitigation described for Alternative 3 and implementing all erosion- and sediment-control measures described for Alternative 2. The modifications described in section 2.5.5.2, *Revegetation* would be implemented for Alternative 4.

#### *2.6.4.1.1 Little Cherry Creek Tailings Impoundment*

Prior to closure, MMC would manage tailings deposition and beaches to ensure that the final tailings surface would slope southwest toward the Diversion Dam (Figure 40). A spillway in the dam would convey surface flow for the final impoundment surface to a diversion ditch and then to the Diversion Channel. Minor modifications to the design of the Diversion Channel, Diversion Dam, and North Saddle Dam would be completed during final design to incorporate this modification.

As in Alternative 3, MMC would survey tailings settlement at closure on a 100-foot by 100-foot grid to document settlement. The area would be resurveyed after borrow material used for fill was placed to create final reclamation gradients, and again after soil placement to ensure runoff gradients were achieved and soil thicknesses were met. Rocky borrow and geotextile would be needed for construction equipment to work on the tailings surface. In Alternative 2, MMC would place riprap on the dam crest and uppermost part of the dam face to minimize potential gully formation at the tailings dam crest. In Alternative 4, MMC would use rocky borrow from within the disturbance area to provide erosion protection. Borrow material volumes would be determined during final design.

MMC would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape. Sand deposition would be varied during final cycloning and placement of sand on the dams. This design would incorporate additional rocky borrow at selected locations on the dam face and use benches in some locations. Islands of trees and shrubs would be planted in the rocky areas. The seed mixture on the dam face would vary to reduce uniformity of the revegetated dam.

#### *2.6.4.1.2 Roads*

Reclamation of the Bear Creek Road, new roads, and all new bridges used in Alternative 4 would be the same as Alternative 2, except for the following changes. In Alternative 4, the two gates on the Little Cherry Creek Loop Road (NFS road #6212) (near the intersection of the Bear Creek

Road on the north side and at the permit area boundary on the south side) would remain in place. Motorized access on Little Cherry Creek Loop Road (NFS road #6212), NFS road #5182, and NFS road #8838 would be restricted to administrative use. All currently gated or barriered roads used in Alternative 4 would be decommissioned by using a variety of treatment methods to achieve desired conditions for other resources.

## 2.6.5 Operational and Post-Operational Monitoring Programs

Operational and post-operational monitoring programs described for Alternative 3 would be implemented for Alternative 4. Plans not modified in Alternative 3 would be the same as Alternative 2. A number of springs and wetlands occur downstream of the proposed Little Cherry Creek Tailings Impoundment. The GDE inventory and monitoring program would be revised slightly from that proposed in Alternative 3.

### 2.6.5.1 Ground Water Dependent Ecosystem Inventory and Monitoring

#### *2.6.5.1.1 Spring and Seep Monitoring*

A GDE inventory of an area overlying the mine area and subsequent monitoring of GDEs would be completed in Alternative 4, as described in Alternative 3. In addition, flow from springs SP-02, SP-10, S-12, SP-14, SP-15, and SP-29 (Figure 41) would be measured twice in Alternative 4, once in early June when the area was initially accessible, and once between mid-August and mid-September 1 year before construction began. (Springs SP-02 and SP-15 would not be monitored if they were covered by impoundment facilities.) Samples from these springs would be collected 1 year before construction began and analyzed for total dissolved solids, nitrate + nitrite, sulfate, antimony, and manganese. Sampling would be repeated every 2 years until tailings disposal ceased. At each spring, a vegetation survey would be completed 1 year before construction began; the survey and establishment of "trigger plants" would be the same as Alternative 3.

#### *2.6.5.1.2 Monitoring of Wetlands Downstream of Tailings Impoundment*

In Alternative 2, MMC would monitor unspecified wetlands downstream of the tailings impoundment annually for the first 5 years of mine operation. In Alternative 4, MMC would monitor three wetlands if not filled by project activities: LCC-24, LCC-25, and LCC-39 (Figure 41). MMC would use the procedures established for monitoring of wetland mitigation sites described in Alternative 3 to assess vegetation characteristics and establish "trigger" species. Trigger species would be used to assess changes in vegetation composition as described in the GDE inventory and monitoring. Samples from any standing water in these three wetlands would be collected in mid-summer 1 year before construction began and analyzed for total dissolved solids, nitrate + nitrite, sulfate, antimony, and manganese. Sampling would be repeated in mid-summer every 2 years until tailings disposal ceased.

## 2.6.6 Mitigation Plans

In Alternative 4, the Wetland Mitigation Plan and the Fisheries Mitigation Plan would differ from that proposed in Alternative 2. The proposed plans for wetlands and fisheries are discussed below. The same general components in the Wildlife Mitigation Plan of Alternative 3 would be incorporated into Alternative 4. The Hard Rock Mining Impact Plan would be the same as Alternative 2.

### 2.6.6.1 Wetland Mitigation

#### *2.6.6.1.1 Proposed Sites*

In Alternative 2, MMC proposed to mitigate affected forested and herbaceous wetlands at a 2:1 ratio, and herbaceous/shrub wetlands and waters of the U.S. at a 1:1 ratio. MMC's proposed mitigation sites are two sites in the Little Cherry Creek drainage, the Little Cherry Creek Diversion Channel, three sites between Little Cherry and Poorman creeks (in Alternative 3, the Poorman Impoundment Site), one site east of the LAD Area 1, and one site at the Libby Creek Recreational Gold Panning Area.

In Alternative 4, possible wetland mitigation sites would include 2.2 acres at the North Little Cherry Creek site; 27.1 acres at the South Poorman, North Poorman, and Poorman Weather Station sites; and 6.7 acres at the Ramsey Creek site (Figure 34). According to MMC, the Poorman Weather Station is not within an area of existing wetlands and has no well-defined drainage. Wetlands created at this site may not be jurisdictional if the site did not have a hydrologic connection to a jurisdictional water. If the wetlands adjacent to the proposed mitigation sites were not jurisdictional wetlands, additional mitigation sites would be developed. One year of ground water monitoring at the mitigation sites, as proposed in Alternative 3, would be implemented in Alternative 4. According to MMC, the Ramsey Creek mitigation site is part of an existing man-made wetland area. MMC would conduct a wetland delineation of the proposed area during final design to ensure the wetland is jurisdictional. If the site were appropriate for mitigation of effects on jurisdictional wetlands, the site would be expanded by spreading out streamflow that would provide hydrologic support.

In Alternative 4, the site at Little Cherry Creek not specifically identified by MMC in Alternative 2 would not be used. At this site, MMC would use ground water collected from beneath the tailings impoundment to create and maintain wetlands. Ground water beneath the tailings impoundment may be mixed with tailings water, and contain elevated nutrients and metal concentrations. Use of ground water beneath the tailings impoundment would not provide hydrologic support after operations cease. The mitigation site at the Libby Creek Recreational Gold Panning Area was not part of the 1993 404 permit. Because of the proximity to high public use at the Recreational Gold Panning Area, it would not be used in Alternative 4.

The Corps would be responsible for developing final mitigation ratios for jurisdictional wetlands, depending on the function and values of the affected wetlands. The minimum ratio for wetland restoration (re-establishment and rehabilitation) is 1.5 acres restored to 1 acre impacted; the minimum ration for establishment is 2 acres established to 1 acre impacted (Corps 2005). Insufficient mitigation sites have been identified to achieve the Corps' minimum ratios, and additional mitigation sites would be necessary if this alternative were permitted.

#### *2.6.6.1.2 Monitoring of Wetland Mitigation Sites*

Monitoring of mitigation sites would be the same as Alternative 3, except for wetlands downgradient of the tailings impoundment (see section 2.5.6.2, *Ground Water Dependent Ecosystem Monitoring*).

### 2.6.6.2 Fisheries Mitigation

#### *2.6.6.2.1 Fish Loss in Little Cherry Creek Diversion*

In Alternative 2, MMC proposed to implement the mitigation developed in 1993 to mitigate the loss of recreational fishing opportunity and the loss of fisheries production in Little Cherry Creek. In Alternative 4, the same mitigation described in section 2.4.6.2, *Fisheries Mitigation* would be implemented, with the following exceptions.

A sediment source inventory in the Libby Creek watershed was one of the menu of possible mitigation projects in Alternative 2. In Alternatives 3 and 4, MMC would conduct an inventory and implement sediment reduction measures in Ramsey, Poorman, and Upper Libby creeks. This mitigation would be required, and not be optional.

Stocking of Ramsey, Standard, or Snowshoe creeks with a trout species of concern was one of the menu of possible mitigation projects in Alternative 2. In Alternative 4, the trout species of concern would be either westslope cutthroat trout or redband trout.

In Alternative 2, a survey and rehabilitation of the fish population in the Kilbrennan Lake was one of the possible mitigation projects. This project has been completed. In Alternative 4, the same project would be completed at Howard Lake.

#### *2.6.6.2.2 Bull Trout Critical Habitat and Sediment*

The proposed mitigation for bull trout critical habitat in Rock Creek, East Fork Bull River, and Libby Creek in Alternative 4 would be the same as Alternative 3. The mitigation for increased sediment in Libby Creek in Alternative 4 would be the same as Alternative 3. This mitigation is discussed in section 2.5.7.2, *Fisheries Mitigation*.

## 2.7 Alternative A—No Transmission Line

In this alternative, MMC would not build a 230-kV transmission line to provide power. The BPA would not tap the Noxon-Libby 230-kV transmission line nor would it build the Sedlak Park Substation. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the transmission line. The DEQ's approval of the Montanore Project, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. The conditions under which the permitting lead agencies could select the No Action Alternative, or deny the transmission line certificate, are described in section 1.6, *Agency Roles, Responsibilities, and Decisions*.

## 2.8 Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative)

The Ramsey Plant Site's electrical service would be 230-kV, 3-phase, 60-cycle, provided by a new, overhead transmission line. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line. MMC's proposed transmission line alignment would be in the watersheds of the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Midas Creek, Libby Creek, and Ramsey Creek (Figure 42). The proposed alignment would head northwest

from the substation for about 1 mile paralleling U.S. 2, and then follow the Fisher River and U.S. 2 north 3.3 miles. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then turn northwest and traverse up a tributary to Miller Creek. The alignment would then cross into the upper Midas Creek drainage, and then down to Libby Creek. The alignment would cross the low ridge between Libby Creek and Ramsey Creek, and then generally follow Ramsey Creek to the Ramsey Plant Site. The maximum annual energy consumed by the project is estimated at 406,000 megawatts, using a peak demand of 50 megawatts.

The characteristics of MMC's proposed North Miller Creek Alignment Alternative and the lead agencies' three other transmission line alignment alternatives are summarized in Table 31. A comparison of the mitigation and modifications the agencies made to the alternatives' to MMC's proposal is presented in Table 32. MMC's proposed alignment (Alternative B) would end at a substation at the Ramsey Plant Site; the lead agencies' alternatives (Alternatives C, D, and E) would end at a substation at the Libby Plant Site. Alternative B, and the other three transmission line alternatives, would require a KFP amendment. This required amendment is discussed in section 2.12, *Forest Plan Amendment*.

Estimated transmission line construction costs range from $7.3 million for Alternative B to $5.4 million for Alternative C. High steel costs would make the steel monopoles proposed in Alternative B considerably more expensive than the wooden H-frame structures proposed in the other alternatives. The lower cost of wooden H-frame structures in Alternatives C, D, and E would offset the cost of helicopters to set structures and clear timber in these alternatives. Estimated mitigation costs range from $14.3 million for Alternative C to $15.0 million for Alternative E. Cost estimates are based on preliminary design and material costs in early 2008.

### 2.8.1 Substation Equipment and Location

Two substations would be required. One substation would be used to tap the Noxon-Libby 230-kV transmission line and supply power to the mine site over a new 230-kV transmission line. BPA's proposed Sedlak Park Substation Site at the Noxon-Libby 230-kV transmission line is in an area known locally as Sedlak Park, 30 miles southeast of Libby on U.S. 2 (Figure 43). At the Ramsey Plant Site, a second, 150-foot by 300-foot substation would be built (Figure 5) to distribute electricity through lower voltage lines to equipment in various locations at the Ramsey Plant Site, the Libby Adit Site, the Little Cherry Creek Tailings Impoundment site, and within the underground mine.

The BPA would design, construct, own, operate, and maintain the Sedlak Park Substation and loop line. The BPA is prohibited by law from providing power directly to a user; Flathead Electrical Cooperative would be the retailer of power to the mine project. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line. The proposed location of Sedlak Park Substation is common to the four transmission line alternatives. Sedlak Park Substation construction would require disturbing 2 acres. The substation would be near U.S. 2 and require a short access road from U.S. 2 (Figure 43). The access road from U.S. 2 would be designed and constructed to MDT standards.

**Table 31. Characteristics of Transmission Line Alignment Alternatives.**

| Characteristic | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| Length (miles)[†] | | | | |
| Steel monopole | 16.4 | 0.0 | 0.0 | 1.4 |
| Wooden H-frame | 0.0 | 13.4 | 14.1 | 13.5 |
| Total | 16.4 | 13.4 | 14.1 | 14.9 |
| Number of structures[‡] | 108 | 80 | 95 | 101 |
| Approximate average span length (ft) | 800 | 885 | 785 | 780 |
| ***Helicopter use*** | | | | |
| Structure placement | At contractor's discretion | 21 structures, primarily in upper unamed tributary of Miller Creek and Midas Creek | 20 structures, primarily in upper Miller Creek | 23 structures, primarily along West Fisher Creek |
| Vegetation clearing | At contractor's discretion | At selected locations; see Figure 45 | At selected locations; see Figure 45 | At selected locations; see Figure 45 |
| Line stringing | At contractor's discretion | Yes, entire line | Yes, entire line | Yes, entire line |
| Annual inspection | Yes | Yes | Yes | Yes |
| ***Estimated cost in millions of 2008 $[¶]*** | | | | |
| Construction | $7.3 | $5.4 | $5.8 | $6.0 |
| Mitigation | $14.9 | $14.5 | $14.5 | $15.0 |

[†]Length is based on line termination at the Ramsey Plant Site in Alternative B and the Libby Plant Site in the other three alternatives.

[‡]Number and location of structures based on preliminary design and may change during final design. The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans.

[¶]Estimated cost used reasonable assumptions regarding costs of construction materials, clearing, land acquisition, and engineering. Final cost could vary from those shown. Estimated construction cost by HDR Engineering, Inc. 2008; estimated construction cost by ERO Resources Corp. 2008.

**Table 32. Comparison of Mitigation in Transmission Line Alternatives.**

| Feature/Resource | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| New Access Road Management | | | | |
| New roads on National Forest System Lands | Soiled and reseeded after construction; used as necessary for mainte-nance; decommissioned at closure | Placed in intermittent stored service after construction; used as necessary for maintenance; decommissioned at closure | Same as Alternative C | Same as Alternative C |
| New roads on Plum Creek lands | Soiled and reseeded after construction; gated and used as necessary for maintenance | Same as Alternative B | Same as Alternative B | Same as Alternative B |
| New roads on other private land | None | None | Soiled and reseeded after construction; gated and used as necessary for maintenance | Same as Alternative D |
| Vegetation Management | | | | |
| Right of Way (ROW) Width | ROW width of 100 feet; danger trees outside the ROW would be removed as necessary; analysis assumed 150-foot clearing width | ROW width of 150 feet; danger trees outside the ROW would be removed as necessary; analysis assumed 200-foot clearing width | Same as Alternative C | Same as Alternative C except for short section of monopoles with a 100-foot ROW |
| Vegetation Clearing | Vegetaton removed | Prepare and implement Vegetation Clearing and Removal Plan; heavy equipment use in RHCAs minimized | Same as Alternative C | Same as Alternative C |
| Helicopter Use for Vegetation Clearing | At contractor's discretion | In areas adjacent to core grizzly bear habitat | Same as Alternative C | Same as Alternative C |

| Feature/Resource | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| Seed Mixes | Interim and permanent seed mixes with native and introduced species | Permanent seed mix with native species only, if commercially available | Same as Alternative C | Same as Alternative C |
| Wildlife see Table 4 for additional mitigation for the mine | | | | |
| Old Growth | Not specified | Designate 222 acres of effective or replacement old growth on National Forest System lands | Designate 247 acres of effective or replacement old growth on National Forest System lands | Designate 247 acres of effective or replacement old growth on National Forest System lands |
| Snags (Cavity Habitat) | Not specified | Leave snags in clearing area, unless required to be removed for safety reasons | Same as Alternative C | Same as Alternative C |
| Down Wood Habitat | Not specified | Leave up to 30 tons per acre of coarse woody debris within clearing area | Same as Alternative C | Same as Alternative C |
| Big Game Security | Not specified | See proposed road access changes in Table 4. No transmission line construction in elk, white-tailed deer, or moose winter range between December 1 and April 30 unless approved by the agencies. | Same as Alternative C | Same as Alternative C |

| Feature/Resource | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| Bald Eagle | Not specified | Fund or conduct surveys to locate active nests in appropriate habitat or not remove vegetation in the nesting season; follow Montana Bald Eagle Management Plan. Construct transmission line according to recommendations outlined in Mitigating Bird Collisions with Power Lines (APLIC 1994) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006) | Same as Alternative C | Same as Alternative C |
| Forest Sensitive Birds and State Bird Species of Concern | Not specified | Complete surveys to locate active nests in appropriate habitat or not remove vegetation in the nesting season | Same as Alternative C | Same as Alternative C |
| Western Toad | Not specified | Retain shrub habitat in wetlands and riparian areas | Same as Alternative C | Same as Alternative C |

| Feature/Resource | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| Migratory Birds | Not specified | Fund or conduct monitoring of landbird populations annually on two, standard Region One monitoring transects within the Crazy and Silverfish PSUs. Construct transmission line according to recommendations outlined in Mitigating Bird Collisions with Power Lines (APLIC 1994) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006) | Same as Alternative C | Same as Alternative C |
| Grizzly Bear | | | | |
| Road and Trail Access changes | See proposed road access changes in Table 4 | See proposed road access changes in Table 4 | Same as Alternative C | Same as Alternative C |
| Land Acquisition for Physical Disturbance | Acquire 79 acres; part of land acquisition described in Table 4 | Secure or protect replacement grizzly bear habitat of 24 acres of private lands in the Cabinet-Yaak Ecosystem | Secure or protect replacement grizzly bear habitat of 27 acres of private lands in the Cabinet-Yaak Ecosystem | Secure or protect replacement grizzly bear habitat of 28 acres of private lands in the Cabinet-Yaak Ecosystem |
| Habitat Enhancement for Reduced Habitat Effectiveness | Not specified | Enhance grizzly bear habitat on 11,324 acres of private lands in the Cabinet-Yaak Ecosystem | Enhance grizzly bear habitat on 12,218 acres of private lands in the Cabinet-Yaak Ecosystem | Enhance grizzly bear habitat on 14,851 acres of private lands in the Cabinet-Yaak Ecosystem |

The substation sites would be fenced. The area surrounding the substation would be graveled and kept free of vegetation. No water would be required at the Sedlak Park Substation site, and toilet facilities would be self-contained. The Sedlak Park Substation would be designed to exclusively serve the mine. No additional lines have been proposed to enter or leave the Sedlak Park Substation.

## 2.8.2 Line and Road Construction Methods

The construction of the proposed transmission line would follow the sequence of: 1) centerline surveyed and staked; 2) ROW cleared and access roads built; 3) work areas cleared and leveled as needed; 4) foundations installed, and transmission line structures erected and installed; 5) ground wire, conductors, and ground rods installed, and 6) the site would be cleaned up and reclaimed.

### 2.8.2.1 Surveying

Construction survey work would consist of establishing a centerline location, specific pole locations, ROW boundaries, work area boundaries, and access roads to work areas. The specified right of way boundaries, work areas, access roads, and other features would be marked with painted laths or flags. Markers would be maintained until final cleanup and/or reclamation was completed, after which they would be removed.

### 2.8.2.2 Access Road Construction and Use

Existing roads would be used for construction access where possible and new roads or spurs would be built only where necessary (Figure 42). New roads would be 12 feet wide and cleared of all trees and shrubs. In the agencies' analysis in Chapter 3, total roadway width, including cuts and fills, was assumed to be 25 feet. Wood refuse and cleared shrubs would be placed on the downhill edge of the road for erosion control. A road within the right-of-way would be required for line stringing operations across side slopes greater than 10 percent. MMC anticipates that no drainage would be provided for the new roads, but would follow the agencies' guidance if installation of culverts were required. No motorized activity associated with transmission line construction would occur from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages. Construction would not occur during the winter in big-game winter range areas. Estimated access road lengths required for each alternative are shown in Table 33. The effects of road use and construction are discussed in sections 3.14, *Land Use;* 3.21, *Vegetation;* and 3.24, *Wildlife Resources*.

Where possible, roads currently open year-round would be used for construction access. Roads currently closed either seasonally or year-round would only be opened for construction access where necessary. Where seasonally closed roads would be used, efforts would be made to minimize their use during the periods when these roads would otherwise be closed. Alternative B would require the use of roads currently closed with a barrier with no administrative use. Table 34 lists those roads with a change in road status in Alternative B.

Roads opened or constructed for transmission line access on National Forest System lands would be closed after the transmission line was built. The road surface would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. The prism of new roads would remain during mine operations. Management of newly constructed roads on Plum Creek land would depend on the easement agreement between Plum Creek and MMC. For purposes of

analysis, the lead agencies assumed newly constructed roads on Plum Creek land would be gated after line construction to allow Plum Creek access.

**Table 33. Miles of Open, Closed, and New Access Roads Required for Transmission Line Construction.**

| Road Type | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| Open road | 20.3 | 22.7 | 19.7 | 12.0 |
| Closed road | 11.8 | 2.8 | 1.7 | 10.3 |
| Extensive upgrade required | 0.3 | 0.0 | 0.0 | 0.7 |
| Other closed roads | 11.5 | 2.8 | 1.7 | 9.6 |
| New road | 9.9 | 3.0 | 3.3 | 3.5 |
| Total | 42.0 | 28.5 | 24.7 | 25.8 |

Source: GIS analysis by ERO Resources Corp. using MMC and HDR Engineering data.

**Table 34. Proposed Change in Road Status, Alternative B.**

| Road # | Road Name | Location | Existing Status | Length (miles) | Proposed Status |
|---|---|---|---|---|---|
| 4773 | Howard Midas Creek | East of Howard Lake | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 1.1 | Gated, construction traffic only |
| 4777 | Lower Midas - Howard Lk | North of Howard Lake | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.9 | Gated, construction traffic only |
| 4778 | Midas Howard Creek | NE of Howard Lake | Barriered year-long to motor vehicles, including snow vehicles | 0.9 | Gated, construction traffic only |
| 4778P | Midas Howard Creek P | NE of Howard Lake | Barriered year-long to motor vehicles, including snow vehicles | 0.3 | Gated, construction traffic only |
| 14403 | Lower Ramsey | Between Libby and Ramsey creeks | Barriered year-long to motor vehicles, open to snow vehicles December 1 through April 30 | 0.5 | Gated, construction traffic only |

Improvement of existing roads would be required in some areas to allow access of construction equipment into the transmission line corridor. Upgrades could include widening, lengthening of culverts, placing fill on or near stream banks, clearing, and regrading. Final design plans detailing the location of work areas and new and existing access roads would be submitted to the lead agencies for approval prior to construction.

MMC identified four possible stream crossing methods in constructing and upgrading roads: fords, culverts, arches, and bridges. MMC anticipates that culverts would be the most commonly used crossing method. BMPs outlined in "Water Quality BMPs for Montana Forests" (Logan 2001) would be followed. Erosion-control BMPs, such as the installation of water bars and dips would be implemented during construction and improvement of access roads. Special considerations could occur in the design and installation of culverts in waters that contain fish or support fisheries habitat. Based on a preliminary design, MMC anticipates requiring new stream crossings of new access roads at six locations: five in an unnamed tributary of Miller Creek, and one in Ramsey Creek. Additional stream crossings may be needed during timber clearing, and line stringing, if a helicopter were not used. Disturbance on active floodplains would be minimized to reduce sedimentation of streams during annual runoff. Construction activities would be restricted or curtailed during heavy rains or high winds to prevent erosion and soil loss. All transmission line alternatives would need to comply with proposed Environmental Specifications for the 230-kV transmission line (Appendix D).

### 2.8.2.3 Vegetation Clearing

The BPA would clear all trees at the Sedlak Park Substation Site, which would include the 2-acre substation and short access road from U.S. to the substation. Trees within the up to 300-foot right-of-way of the loop line also would be cleared. The BPA would conduct a noxious weed survey at the proposed Sedlak Park Substation Site before and after construction of the substation. It also would revegetate all disturbed areas outside of the access road prism and substation yard.

For the new 230-kV transmission line to the mine, most construction activity would be contained in the 100-foot right-of-way for steel monopole structures (Figure 44) with major exceptions being access road construction and conductor pulling and stringing. General right-of-way clearing would be governed by safety, reliability, environmental, and cost considerations. A 100-foot right-of-way would be cleared as necessary and additional tree clearing outside the 100-foot right-of-way would be necessary to prevent trees from falling into the line, or fires from flashovers where trees were too close to the conductor. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 150 feet of clearing along the entire alignment (Figure 44). Some areas within the 150-foot clearing area would not require clearing, such high spans across valleys. Actual acreage cleared would be less and would depend on tree height, slope and line clearance above the ground. Clearing would produce a "feathered" edge on the right-of-way clearing, with the width of right-of-way clearing varying along the line. Trees within the right-of-way would be removed to provide a minimum of 18 feet clearance between the vegetation and the conductor. Trees that would extend within 18 feet of the conductors within 5 years also would be removed. Other trees on or off the right-of-way that could fall into the line would be removed. In some areas, such as steep drainages, trees beneath the line would not be cleared if there were sufficient clearance between the line and the tree. Merchantable timber would be measured, purchased from the KNF, and then salvaged from the right-of-way; cleared smaller trees and brush would be burned or chipped. Non-merchantable trees and slash would be piled into windrows (using a brush blade to minimize soil accumulation) and burned. MMC did

not specify the type of vegetation clearing that would be used. For analysis purposes, the lead agencies assumed all vegetation clearing would be completed conventionally without the use of a helicopter.

#### 2.8.2.4 Foundation Installation

Excavations for foundations would be made with power auger equipment. Where the soil permits, a vehicle-mounted power auger would be used. The foundation excavation and installation requires equipment access to the foundation sites. If rocky areas were encountered, foundations may require blasting. The foundation excavation and installation would require access to the site by a power auger or drill, a crane, material trucks, and ready-mix trucks. Concrete for use in constructing foundations would be obtained from commercial sources or from a remote batch plant on private land, depending on contractor needs.

Foundation holes left open or unguarded would be covered and/or fenced where practical to protect the public and wildlife. Soil removed from foundation holes would be stockpiled on the work area and used to backfill holes. All remaining soil not needed for backfilling would be spread on the work area. Concrete trucks would wash their chute debris into a depression in the permanent disturbance area at the pole site and soil from the foundation excavation would be used to cover the chute debris.

Where bedrock was encountered while excavating structure holes, a rock drill and compressor would be used to drill the rock. A hole would be blasted using explosives. Blasting would not expand the area needed for operations around the hole, but would increase the amount and duration of associated construction activity. It also would slightly affect the sequence and schedule of operations around those holes, extending the amount of time that the structures remain at the site before they can be set.

#### 2.8.2.5 Structure Installation

MMC would use steel monopole structures a maximum of 95 feet high along the 100-foot right-of-way (Figure 44; Table 35). The distance between structures would vary from less than 200 feet to more than 2,000 feet, depending on the alignment selected and terrain crossed (Figure 42; Table 35). The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans and to achieve the proposed structure height. The cor-ten steel structures would be built to provide low reflectivity and long life. Cor-ten steel develops a stable rust-like appearance if exposed to the weather for several years. Tree clearing also would vary depending on span length and tree and structure height. MMC would work with the lead agencies to optimize structure height and span length to minimize concerns over tree clearing and visual considerations along any approved alignment and centerline.

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes an angle. These sites usually require an area up to 40 feet by 150 feet. The proposed alignment would require 11 of these sites.

**Table 35. Comparison of H-frame and Monopole Structures.**

| Design Element | H-Frame | Monopole |
|---|---|---|
| Right-of-Way Width (ft) | 150 | 100 |
| Estimated Clearing Width (ft) | 200 | 150 |
| Peak current loading (amps) | 125 | 125 |
| Nominal Voltage (volts) | 230,000 (230-kV) | 230,000 (230-kV) |
| Conductor Size | 795 kcmil Drake | 795 kcmil Drake |
| Conductor Type | ACSR | ACSR |
| Overhead Ground Wire (Approximate) | 1 3/8-inch-dia galv and 1 Optical ground wire | Optical ground wire (diameter of <0.433 inches) |
| Electric field at edge of right-of-way at 3 ft above ground level (kV/m) | 0.52 | 0.62 |
| Magnetic field at edge of right-of-way (mG) | 3.2 | 1-conductor side: 4.0<br>2-conductor side: 4.2 |
| Typical Structure Height above Ground (ft) | 74.5 | 83.5[†] |
| Minimum Ground Clearance of Conductor (ft at 212° F)[‡] | 25 | 25 |
| Typical Structure Base Dimensions | 2 poles, 2 foot x 2 foot | 1 pole, 17.33 inch diameter |
| Total land temporarily disturbed for conductor reel and pole storage yards (acres) | Similar to monopole | Up to 3.5 |

[†]Additional structures and access may be needed to avoid long spans and to achieve the proposed structure height.
[‡]Minimum ground clearance used in developing preliminary plan and profiles; actual ground clearance would vary.
ACSR = aluminum core steel reinforced; Kcmil = 1,000 circular mils; kV = Kilovolts;
kV / m = kilovolts per meter; mG = milligauss
Source: MMI 2005b; Power Engineers 2005; HDR Engineering 2007.

Structure construction activity is expected to occur within 30 feet of the holes where the structures would be installed. Activities conducted outside the 30-foot radius would include pole assembly, framing conductor supports and establishing an operating location for the crane. The optimal crane operating conditions require that the crane be as close to the hole as possible but because of uneven terrain at certain sites, cribbing with timbers under the crane outriggers would be necessary to level the crane. The need for the crane to be outside of the 30-foot radius would probably be the exception. Temporary construction yards may be necessary and would be located on existing disturbed areas or other areas on private lands along the line alignment.

### 2.8.2.6 Line Stringing

Once structures were in place, a pilot line would be pulled (strung) from structure to structure and threaded through the stringing sheaves on each structure. A larger diameter, stronger line would then be attached to the pilot line. This is called the pulling line, and one pulling line is connected to a conductor or overhead ground wire. Each conductor or ground wire is then pulled through the sheaves in succession and held under tension until connected to the insulators. This process

would be repeated until all the ground wires and conductors were pulled through all sheaves. Conductor splicing would be required at the end of a conductor spool or if a conductor were damaged during stringing. The work would occur on work areas for the structures or pulling/tensioning sites. Conductors would be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end. For public protection during wire installation, guard structures would be erected over roadways, transmission lines, structures, and other obstacles. Guard structures consist of temporary H-frame structures placed on either side of an obstacle.

Helicopters may be necessary to assist in the construction of the line where ground access was not possible or where the contractor decided it would be cost effective. In such cases, helicopters would be used to bring equipment to structure sites, place transmission structures, and string the conductor. This method of construction would replace the need for small portions of access roads in these locations, and would eliminate vehicle access to the structures to perform maintenance activities. Maintenance in these structure locations would be limited to helicopter access and maintenance or pedestrian access. Ground disturbance associated with the use of helicopter construction would include work areas for each structure site measuring about 15 feet by 15 feet, depending on the topography of the site. All necessary equipment would be lowered from a helicopter to allow foundation installation and structure setting. Vegetation would be removed and the work area would be graded by hand to flatten as needed for the safe operation of equipment and access by work crews. In the lead agencies' analysis of the North Miller Creek Alternative (Alternative B) in Chapter 3, no helicopter use to construct structures was assumed. Helicopter use was assumed for line stringing as helicopter use is expected to be less expensive than conventional ground stringing. Helicopter use for line stringing would take about 10 days.

Three conductors with a horizontal spacing of about 20 feet and a vertical spacing of 6.5 feet are proposed. A fiber optic static wire for protection against lightning strikes and communication would be located at the top of each structure 17 feet above the top conductor.

### 2.8.3 Operation, Maintenance, and Reclamation

The line would be designed and operated to comply with applicable standards. MMC would be governed by the Environmental Specifications for the 230-kV transmission line (Appendix D) to guide line construction, operation, maintenance, and decommissioning activities. To minimize the potential for bird collisions or electrocution, the line would be constructed according to recommendations outlined in Mitigating Bird Collisions with Power Lines (APLIC 1994) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006).

Following construction, land within the right-of-way and other disturbed areas outside of the right-of-way, such as tensioning sites, that had been rutted, compacted, or disturbed would be reclaimed. Access roads would be regraded, scarified, and seeded. All permanent cut-and-fill slopes on maintenance roads would be seeded, fertilized, and stabilized with hydromulch, netting, or other methods. Drive-through dips, open-top box culverts, waterbars, or crossdrains would be installed on maintenance roads to prevent erosion. Unauthorized traffic would be blocked with appropriate structures.

As part of the monitoring program, monitoring at monthly intervals during the growing season would be conducted along the right-of-way and access roads to detect the invasion of spotted knapweed or other noxious weeds. Spotted knapweed plants found on areas disturbed by the

project would be treated by spot spraying individual plants. Herbicides would be carried in tanks mounted on vehicles or in backpack tanks. Herbicide spray would be applied only when wind velocity was less than 8 miles per hour to prevent wind drift. No herbicides would be applied within 25 feet of water bodies. All herbicide applications would be in compliance with all applicable state and federal regulations.

Inspection and repair of the line would be conducted by helicopter. Line inspections would be conducted annually to assess structural integrity and to identify maintenance needs; additional inspections may be needed after a fire or ice storm. MMC estimates a line crew would access the line about 5 days per year for maintenance of hardware and removal of trees. MMC would rely on the BPA followed by Flathead Electrical Cooperative and then MMC's own resources for installation, maintenance, repairs, and inspections.

Hazard trees that would interfere with or fall into the transmission line or associated facilities would be identified during routine maintenance inspections. Targeted trees and tall shrubs would be removed through manual or mechanical means. Clearing of danger trees and tall shrubs would continue until the line was decommissioned. Slash would be lopped and scattered evenly throughout the surrounding terrain. Stumps would be cut to less than 1 foot tall, and lopped slash would be left as close to the ground as possible.

Land use in the right-of-way normally would not be restricted except for those activities that interfere with the line operation and maintenance. Line operation would not require any permanent employees, although MMC would have a trained fire crew and would cooperate with the KNF and local fire departments in controlling forest fires in the area.

MMC expects the transmission line facilities would be the last facilities reclaimed following mine closure. Newly constructed roads needed for construction of the transmission line would be soiled and reseeded immediately after construction was completed. Because the access roads would rarely be used following construction, MMC anticipates these roads would have stabilized naturally or by MMC through interim reclamation. The substation at the plant site would be removed. MMC would remove all other transmission line equipment at closure, such as structures, insulators, line, and other hardware from the right-of-way. All concrete foundations/footers would be broken up and buried in place. Poles and other structures would be dismantled and sold, scraped, and/or disposed of off-site. After the transmission line was removed, all newly constructed roads on National Forest System lands would be bladed and recontoured to match existing topography, obliterating the road prism. Management of newly constructed roads on Plum Creek land after the transmission line was removed would depend on the easement agreement between Plum Creek and MMC. Where culverts were removed, stream banks would be recontoured and reseeded. Native shrubs, such as alder or willow, would be planted on stream banks to reduce bank erosion during high streamflow.

The BPA would dismantle the substation and remove the loop line following mine closure, assuming it had no need for the facilities. The substation and access road would be revegetated after materials had been removed from the site.

## 2.9 Alternative C—Modified North Miller Creek Transmission Line Alternative

### 2.9.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal described in Alternative B. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

The primary modification to MMC's proposed North Miller Creek alignment in Alternative B would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River. This modification would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing soils less area with soils that are highly erosive and subject to high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from U.S. 2. Fewer residences would be within 0.5 mile of the line. Other modifications to the alignment are relatively small shifts along Miller Creek and an unnamed tributary to Miller Creek. During final design, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval. The plan's goal would be to minimize vegetation clearing. The modifications were made to avoid and minimize effects on RHCAs along drainages (Issue 3) and to avoid steep slopes in the headwaters of the unnamed tributary of Miller Creek.

Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on Alternative C. In some locations, a helicopter would be used for vegetation clearing and structure construction. The lead agencies selected helicopter use to eliminate the need to use or construct roads in or adjacent to core grizzly bear. Helicopter construction also would reduce effects on lynx habitat. Access roads on National Forest System lands would be placed into intermittent stored service after construction, and decommissioned after the transmission line was decommissioned. Intermittent stored service and road decommissioning are discussed in section 2.9.3.2, *Access Road Construction and Use*. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. The issues addressed by the modifications and mitigation measures are summarized in Table 36. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

**Table 36. Response of Alternative C Modifications and Mitigations to Issues.**

| Key Issue | Alignment | Structure Type | Construction Techniques |
|---|---|---|---|
| Issue 1-Acid Rock Drainage and Metal Leaching | | | |
| Issue 2-Water Quality and Quantity | ✓ | ✓ | ✓ |
| Issue 3-Aquatic Life | ✓ | ✓ | ✓ |
| Issue 4-Visual Resources | ✓ | ✓ | ✓ |
| Issue 5-Threatened or Endangered Species | ✓ | ✓ | ✓ |
| Issue 6-Wildlife | ✓ | ✓ | ✓ |
| Issue 7-Wetlands and Non-wetland Waters of the U.S. | | | |

## 2.9.2 Alignment and Structure Type

### 2.9.2.1 Preconstruction Surveys

In Alternatives 3 and 4, MMC would complete before final design and any ground-disturbing activities an intensive cultural resources survey and a jurisdictional wetland delineation on all areas proposed for disturbance for any areas where such surveys have not been completed and that would be disturbed by the alternative. Similarly, MMC would complete a survey for threatened, endangered, or Forest sensitive plant species on National Forest System lands for any areas where such surveys have not been completed and that would be disturbed by the alternative. Similarly, MMC would conduct surveys in suitable habitat for threatened, endangered, and state-listed plant species potentially occurring on non-National Forest System lands. The surveys would be submitted to the agencies for review and comment. If adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities. To the extent feasible, MMC would make adjustments to structure and road locations, and other disturbing activities to reduce impacts.

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would traverse an east-facing ridge immediately north northwest of the substation, and would cross Hunter Creek 2 miles north northwest of the substation. The alignment would continue north northwest for 2.5 miles and head west to cross the Fisher River and U.S. 2 a few hundred feed north of MMC's proposed alignment. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then traverse up a tributary to Miller Creek. The alignment would be north of the alignment proposed in Alternative B, reducing the effect on RHCAs along Miller Creek. The alignment would then follow an unnamed tributary of Miller Creek and then cross into the upper Midas Creek drainage, and then down into the Libby Creek drainage, ending at the Libby Plant Site.

MMC would use the same general methods to operate, maintain, and reclaim the line and access roads as Alternative B. Wooden H-frame structures would be used instead of the steel monopoles proposed by MMC in the North Miller Creek Alternative. The lead agencies selected wooden H-frame structures to reduce structure height. H-frame structures also would provide for longer span lengths and consequently would require fewer structures and access roads (Table 31). Using H-frame structures would require more right-of-way and tree clearing (Figure 44). To eliminate the need to use or construct roads that may affect core grizzly bear habitat, structures constructed using a helicopter would be at 21 locations in the Miller Creek, Midas Creek, and Howard Creek drainages (Figure 45).

Based on a preliminary design, two structures would be in a RHCA on National Forest System lands and four structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible.

## 2.9.3 Line and Road Construction Methods

### 2.9.3.1 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the following changes. BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B. During final

design, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval (see section 2.5.3.2.1, *Vegetation Removal and Disposition* in the Alternative 3 discussion). One of the plan's goals would be to minimize vegetation clearing. The plan would identify areas where clearing would be avoided, such as deep valleys with high line clearance, and measures that would be implemented to minimize clearing. The plan also would evaluate the potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during life of the line. For example, the growth factor used to assess which trees would require clearing could be reduced in sensitive areas, such as RHCAs, from 15 years to 5 to 8 years. Reducing the growth factor could reduce clearing width, but increase maintenance costs. Heavy equipment use in RHCAs would be minimized. Shrubs in RHCAs would be left in place unless they had to be removed for safety reasons. Vegetation management in riparian areas on private lands would be decided by MMC and the private landowner.

Most construction activity would be contained in the 150-foot right-of-way with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along the entire alignment (Figure 44). In areas adjacent to core grizzly bear habitat, MMC would use a helicopter to clear timber, reducing the need for access roads (Figure 45). Conventional vegetation clearing techniques would be used in other areas. Merchantable timber would be transported to designated landings or staging areas, and branches and tops would be removed and piled. Helicopter landing sites would generally be on roads (Figure 45). The KNF would be responsible for disposing of the piles. Non-merchantable material would be left within the transmission line clearing area, and would be lopped and scattered. Large woody debris would be left as necessary to comply with the wildlife mitigation described in Alternative 3 (see section 2.5.7.3.2, *Key Habitats*).

### 2.9.3.2 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to Alternative B. Estimated access road requirements are shown on Figure 45. A final Road Management Plan described in Alternative 3 (section 2.5.4.5.1, *Road Management Plan*) would be developed and implemented for Alternatives C, D, and E.

During final design, MMC would conduct a field inspection with the agencies to review all stream crossings by new roads. The type of stream crossing would be determined based on the field inspection. Where needed, culverts would be sized generally to convey the 100-year storm, but culvert sizing would be determined on a case-by-case basis with the lead agencies' approval of final sizing.

In all transmission line alternatives, roads built for the installation of the transmission line would be needed for future reclamation of the line. The KNF would change the status of new transmission line roads on National Forest System lands to intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to motorized traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. They would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Intermittent stored service roads would require some work to return them to a drivable condition. Intermittent stored service road treatments would include:

- Conducting noxious weed surveys and performing necessary weed treatments prior to storage activities

- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high-risk for blockage or failure; laying back stream banks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch would not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material would not present a future risk to watershed function
- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential

New transmission line roads on National Forest System lands would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. In addition to all the intermittent stored service road treatments, a decommissioned road would be treated by one or more of the following measures:

- Conducting noxious weed surveys and performing necessary weed treatments prior to decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Fully obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism
- Removing unstable fills

Newly constructed roads on Plum Creek lands would be gated after construction and managed as proposed by MMC in Alternative B. MMC would be able to use roads on Plum Creek lands for inspections and maintenance. Alternative C would not require roads or structures on any other private land other than Plum Creek. Alternative C would require the use of roads currently barriered with no administrative use. Table 37 lists those roads with a change in road status in Alternative C. These two roads are on Plum Creek land just west of U.S. 2 and are currently closed to public access. Consequently, the two roads are not shown on any figure.

### 2.9.3.3 Line Stringing

A helicopter would be used for line and ground wire stringing in Alternative C.

**Table 37. Proposed Change in Road Status, Alternative C.**

| Road # | Road Name | Location | Existing Status | Length (miles) | Proposed Status |
|---|---|---|---|---|---|
| 99834 | Waylett Flat 99834 | On Plum Creek land just west of U.S. 2 | Barriered | 0.1 | Gated, MMC and Plum Creek traffic only |
| 99834A | Waylett Flat 99834A | On Plum Creek land just west of U.S. 2 | Barriered | <0.1 | Gated, MMC and Plum Creek traffic only |

#### 2.9.3.4 Operation, Maintenance, and Reclamation

As in Alternative B, annual inspection of the line would be conducted by helicopter in the other transmission line alternatives. Roads placed in intermittent stored service or decommissioned would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Increased helicopter use would be required to conduct routine maintenance. Clearing of danger trees would continue until the line was decommissioned.

### 2.9.4 Wildlife Mitigation Measures

Mitigation common to both the mine and transmission line alternatives is discussed in section 2.5.7, *Mitigation Plans* under Mine Alternative 3. Some monitoring described for Mine Alternative 3 also would apply to transmission line alternatives (see section 2.5.6, *Operational and Post-Operational Monitoring Programs*).

#### 2.9.4.1 Down Wood Habitat

MMC would leave large woody material for small mammals and other wildlife species within the cleared transmission line corridor on National Forest System lands. Woody material would be scattered and not concentrated within the clearing area. Piece size should exceed 3 inches in diameter, and preference would be for a down "log" to be at least 8 feet in length with a small-end diameter of 6 inches or more. This material would originate from existing logs on site, unused portions of designated cut trees, broken tops, or similar materials. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan. Monitoring of woody material would be implemented through a timber sale contract. The following amounts of coarse woody debris (CWD) would be left:

- Vegetative Response Unit (VRU) 1: leave 5 to 9 tons (6 to 14 logs) per acre of CWD on site after timber clearing
- Vegetative Response Unit (VRU) 2 and 9: leave 10 to 15 tons (15 to 20 logs) per acre of CWD on site after timber clearing
- Vegetative Response Unit (VRU) 3, 4, and 5: leave 15 to 30 tons (23 to 30 logs) per acre of CWD on site after timber clearing

### 2.9.4.2 Sensitive Species and Other Species of Interest

#### *2.9.4.2.1 Bald Eagle*

MMC would fund or conduct field and/or aerial reconnaissance surveys to locate any new bald eagle or osprey nests along specific segments of the transmission line corridor in Alternatives C, D, and E. Surveys would be conducted between March 15 and April 30, one nesting season prior to transmission line construction. The survey could be integrated into the current monitoring program of the Libby Ranger District, or could be contracted by MMC. Transmission line segments to be surveyed by alternative would be:

- Alternative C: from Sedlak Park Substation in Section 9 Township 26 North, Range 29 West to the western edge of Section 19 Township 27 North, Range 29 West in Miller Creek
- Alternative D: from Sedlak Park Substation in Section 9 Township 26 North, Range 29 West to the western edge of Section 19 Township 27 North, Range 29 West in Miller Creek; and from the northern end of Section 19 Township 27 North, Range 30 West to the northern edge of Section 13 Township 27 North, Range 31 West, which is the area to the east and northeast of Howard Lake
- Alternative E: from Sedlak Park Substation in Section 9 Township 26 North, Range 29 West to the western edge of Section 4 Township 27 North, Range 29 West in West Fisher Creek; and from the northern end of Section 19 Township 27 North, Range 30 West to the northern edge of Section 13 Township 27 North, Range 31 West, which is the area to the east and northeast of Howard Lake

If an active nest were found, guidelines from the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 1994) would be followed to provide management guidance for the immediate nest site area (Zone 1), the primary use area (Zone 2), and the home range area (Zone 3). This would include delineating a 0.25-mile buffer zone for the nest site area, along with a 0.5-mile buffer zone for the primary use area. High intensity activities, such as heavy equipment use, would not be permitted during the nesting season (February 1 to August 15) within these two zones. Guidelines recommended by the USFWS at the time of project implementation would be followed if different from the Montana Bald Eagle Management Plan Management guidelines.

MMC has committed to constructing the transmission line according to recommendations outlined in Mitigating Bird Collisions with Power Lines (APLIC 1994) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006). Specific recommendations that would be implemented are described for migratory birds in section 2.9.4.4, *Migratory Birds* below.

#### *2.9.4.2.2 Western Toad*

In transmission line Alternatives C, D, or E, all shrub habitat would be retained in wetlands and riparian areas crossed by the proposed transmission line. Wetlands avoidance, minimization, and mitigation and avoidance measures (see section 2.4.6.1, *Wetland Mitigation Plan*) also would ensure that impacts to western toad breeding habitat were minimized.

### 2.9.4.3 Elk, White-tailed Deer, and Moose Winter Habitat

MMC would not conduct transmission line construction activities in elk, white-tailed deer, or moose winter range between December 1 and April 30. These timing restrictions may be waived in mild winters if MMC could demonstrate that snow conditions were not limiting the ability of

these species to move freely throughout their range. MMC must receive a written waiver of these timing restrictions from the KNF, DEQ, and FWP, before conducting construction activities on elk, white-tailed deer, or moose winter range between December 1 and April 30. Timing restrictions would not apply to substation construction.

#### 2.9.4.4 Migratory Birds

MMC has committed to constructing the transmission line according to recommendations outlined in Mitigating Bird Collisions with Power Lines (APLIC 1994) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006). MMC would ensure the following recommendations would be implemented:

**During Construction**

- Provide 60-inch minimum horizontal separation between energized conductors and/or energized conductors and grounded hardware.
- Provide 36-inch minimum vertical separation between energized conductors and/or energized conductors and grounded hardware.
- Insulate hardware or conductors against simultaneous contact were adequate spacing were not possible. If transformers, cutouts, or other energized or grounded equipment were present on the structure, then jumpers, cutouts, and bushings should be covered to decrease the chance of a bird electrocution.
- Covering conductors may be necessary at times if adequate separation of conductors, or conductors and grounded parts, could not be achieved. On three phase structures, the cover should extend a minimum of 3 feet from the pole top pin insulator.
- Discourage birds from perching in unsafe locations by installing bird perch guards (triangles) or triangles with perches.
- Increase the visibility of conductors or shield wires where necessary to prevent avian collisions. This may include installation of marker balls, bird diverters, or other line visibility devices placed in varying configurations, depending on line design and location. Areas of high risk for bird collisions where such devices may be needed, such as major drainage crossings, and recommendations for type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

**During Operations**

- Replace or modify a structure where there has been a documented problem with a nest site or an avian electrocution. This may include the installation of elevated perches (or nesting platforms in the case of osprey).

### 2.9.5 Other Modifications

Prior to final design and any ground-disturbing activities, MMC would complete an intensive cultural resources survey and a jurisdictional wetland delineation on all areas proposed for disturbance for any areas where such surveys have not been completed and that would be disturbed by the alternative. MMC would complete a survey for threatened, endangered, or Forest sensitive plant species on National Forest System lands for any areas where such surveys have

not been completed and that would be disturbed by the alternative. Similarly, MMC would conduct surveys in habitat suitable for threatened, endangered, and state-listed plant species potentially occurring on non-National Forest System lands. Modifications described in Alternative 3 for the mine, such as seed mixtures (Table 18), revegetation success, and weed control, would be implemented in Alternative C.

## 2.10 Alternative D—Miller Creek Transmission Line Alternative

### 2.10.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, road construction and post-construction management, line stringing, operation, maintenance, and reclamation, and seed mixtures described in Alternative C. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

Like the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive and subject to high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from U.S. 2. Fewer residences would be within 0.5 mile of the line. Other modifications to the alignment are relatively small shifts along Miller Creek to avoid RHCAs along drainages (Issue 3). The issue of effects on threatened or endangered species (Issue 5) was addressed by routing the alignment along Miller Creek and avoiding core grizzly bear and lynx habitat in North Miller Creek and the unnamed tributary of Miller Creek.

This alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. In the 1992 Final EIS, a similar alignment was considered, but was eliminated in part because of visual concerns from Howard Lake. The issue of scenic quality from Howard Lake was addressed by using H-frame structures, which would be shorter than steel monopoles. In addition, screening vegetation has grown taller between the lake and the alignment in the intervening 15 years. More detailed engineering was completed for the alternatives analyzed in this EIS, and H-frame structures would be used to minimize the visibility of the line from Howard Lake (Issue 4).

As in Alternative C, a helicopter would be used for vegetation clearing and structure construction in some locations. New access roads on National Forest System lands would be managed in the same manner as Alternative C. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. The issues addressed by the modifications and mitigation measures are summarized in Table 38. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

**Table 38. Response of Alternative D Modifications and Mitigations to Issues.**

| Key Issue | Alignment | Structure Type | Construction Techniques |
|---|---|---|---|
| Issue 1-Acid Rock Drainage and Metal Leaching | | | |
| Issue 2-Water Quality and Quantity | ✓ | ✓ | ✓ |
| Issue 3-Aquatic Life | ✓ | ✓ | ✓ |
| Issue 4-Visual Resources | ✓ | ✓ | ✓ |
| Issue 5-Threatened or Endangered Species | ✓ | ✓ | ✓ |
| Issue 6-Wildlife | ✓ | ✓ | ✓ |
| Issue 7-Wetlands and Non-wetland Waters of the U.S. | | | |

## 2.10.2 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would follow the same alignment as Alternative C until 2 miles west of U.S. 2 (Figure 45). After departing from the Modified North Miller Creek alignment, this alternative would follow Miller Creek to an east-facing ridge separating Miller Creek from the Standard Creek drainage. The alignment would traverse the ridge into the Howard Creek drainage. The alignment would cross the northeast corner of private land about 0.5 mile south of Howard Lake (Figure 45). One structure and a short access road may be located on this property. Past the private land, the alignment would generally parallel Howard Creek and eventually be the same as the Modified North Miller Creek alignment.

The lead agencies selected wooden H-frame structures to reduce structure height. H-frame structures also provide for longer span lengths and consequently fewer structures and access roads (Table 31). Using H-frame structures would require more right of way and tree clearing (Figure 44). To eliminate the need to use or construct roads that may affect core grizzly bear habitat, a helicopter would be used for structure construction at 21 locations in the Miller Creek and Howard Creek drainages (Figure 45). Other mitigation described in Alternative C would be incorporated into Alternative D.

Based on a preliminary design, five structures would be in a RHCA on National Forest System lands and four structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible.

## 2.10.3 Line and Road Construction Methods

### 2.10.3.1 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to in Alternative B. Estimated access road requirements are shown on Figure 45. MMC would develop and implement a final Road Management Plan. In Alternative D, new access roads on National Forest System lands would be managed in the same manner as Alternative C.

Newly constructed roads on Plum Creek lands would be gated after construction and managed as proposed by MMC in Alternative B. MMC would be able to use roads on Plum Creek lands for inspections and maintenance. Preliminary design of Alternative D indicates one H-frame structure and one access road to the structure would be needed on each of two private land parcels, one with a residence along Miller Creek west of the Plum Creek parcel and one south of Howard Lake. Road management would depend on the easement agreement between the landowner and MMC. For purposes of analysis, the lead agencies assumed these two roads would be managed in the same manner as roads on Plum Creek lands.

Alternative D would require the use of roads currently barriered with no administrative use. Table 39 lists those roads with a change in road status in Alternative D. These two roads are on Plum Creek land just west of U.S. 2 and are currently closed to public access. Consequently, the two roads are not shown on any figure.

**Table 39. Proposed Change in Road Status, Alternative D.**

| Road # | Road Name | Location | Existing Status | Length (miles) | Proposed Status |
|---|---|---|---|---|---|
| 99834 | Waylett Flat 99834 | On Plum Creek land just west of U.S. 2 | Barriered | 0.1 | Gated, MMC and Plum Creek traffic only |
| 99834A | Waylett Flat 99834A | On Plum Creek land just west of U.S. 2 | Barriered | <0.1 | Gated, MMC and Plum Creek traffic only |

#### 2.10.3.2 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the modifications of Alternative C incorporated. BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B. Most construction activity would be contained in the 150-foot right-of-way (Figure 44) with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along the entire alignment (Figure 44). In areas adjacent to core grizzly bear habitat, MMC would use a helicopter to clear vegetation, reducing the need for access road (Figure 45). Helicopter landing sites would generally be on roads (Figure 45).

### 2.10.4 Other Modifications

Modifications described in Alternative 3 for the mine or Alternative C for the transmission line (*e.g.*, cultural resource, wildlife, plant, and wetland surveys; wildlife mitigation; seed mixtures (Table 18); revegetation success; and weed control) would be implemented in Alternative D.

## 2.11 Alternative E—West Fisher Creek Transmission Line Alternative

### 2.11.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, road construction and post-construction management, line stringing,

operation, maintenance, and reclamation, and seed mixtures described in Alternative C. Some steel monopoles would be used in the steep section 2 miles west of U.S. 2 (Figure 45). This alternative could be selected with any of the mine alternatives. For analysis purposes, the lead agencies assumed this alternative would terminate at the Libby Plant Site.

Like the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alternative by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification would address issues associated with water quality (Issue 2) by crossing less area with soils that are highly erosive and subject to high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from U.S. 2. Fewer residences would be within 0.5 mile of the line.

The primary difference between the West Fisher Creek Alternative (Alternative E) and the North Miller Creek Alternative (Alternative B) is routing the line on the north side of West Fisher Creek and not up the Miller Creek drainage to minimize effects on core grizzly bear habitat. As in Alternative D, this alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area; H-frame structures would minimize visibility from the lake.

Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on this alternative in most locations to minimize the visibility of the line from Howard Lake (Issue 4). In some locations, a helicopter would be used for vegetation clearing and structure construction. New access roads on National Forest System lands would be managed in the same manner as Alternative C. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. The issues addressed by the modifications and mitigation measures are summarized in Table 40. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

**Table 40. Response of Alternative E Modifications and Mitigations to Issues.**

| Key Issue | Alignment | Structure Type | Construction Techniques |
|---|---|---|---|
| Issue 1-Acid Rock Drainage and Metal Leaching | | | |
| Issue 2-Water Quality and Quantity | ✓ | ✓ | ✓ |
| Issue 3-Aquatic Life | ✓ | ✓ | ✓ |
| Issue 4-Visual Resources | ✓ | ✓ | ✓ |
| Issue 5-Threatened or Endangered Species | ✓ | ✓ | ✓ |
| Issue 6-Wildlife | ✓ | ✓ | ✓ |
| Issue 7-Wetlands and Non-wetland Waters of the U.S. | | | |

## 2.11.2 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would follow the same alignment as Alternative C until just north of Hunter Creek (Figure 45). After departing from the Modified North Miller Creek alignment, this alternative would cross the Fisher River and West Fisher Creek and follow West Fisher Creek until its confluence with Standard Creek. It would follow a small tributary to West Fisher Creek, and would eventually be the same as the Miller Creek alignment. Two residences are between 350 and 400 feet of the centerline shown on Figure 78, one near the Fisher River crossing and one on private land 3 miles west of U.S. 2. Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. To minimize the risk of elevated electric and magnetic fields, the centerline during final design of this alternative would be no closer than 200 feet of these residences. Electric and magnetic fields are discussed in section 3.19.4.2, *Electrical and Magnetic Fields*.

The lead agencies selected wooden H-frame structures to reduce structure height along most of the West Fisher Creek alignment. H-frame structures also provide for longer span lengths and consequently fewer structures and access roads (Table 31). Using H-frame structures would require more right of way and tree clearing (Figure 44). Some steel monopoles would be used in steep areas 2 miles west of U.S. 2. To eliminate the need to use or construct roads that may affect core grizzly bear habitat, 21 structures along West Fisher Creek would be constructed using a helicopter (Figure 45). Other mitigations described in Alternative C would be incorporated into Alternative E.

Based on a preliminary design, five structures would be in a RHCA on National Forest System lands and eight structures would be in a riparian area on private or state lands. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible.

## 2.11.3 Line and Road Construction Methods

### 2.11.3.1 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to in Alternative B. Estimated access road requirements are shown on Figure 45. MMC would develop and implement a final Road Management Plan. New access roads on National Forest System lands in Alternative e would be managed in the same manner as Alternative C.

Newly constructed roads on Plum Creek lands would be gated after construction and managed as proposed by MMC in Alternative B. MMC would be able to use roads on Plum Creek lands for inspections and maintenance. Preliminary design of Alternative E indicates one H-frame structure and one access road to the structure would be needed on one private land parcel south of Howard Lake. Road management would depend on the easement agreement between the landowner and MMC. For purposes of analysis, the lead agencies assumed this road would be managed in the same manner as roads on Plum Creek lands.

Alternative E would require the use of roads currently barriered with no administrative use. Table 41 lists those roads with a change in road status in Alternative E.

**Table 41. Proposed Change in Road Status, Alternative E.**

| Road # | Road Name | Location | Existing Status | Length (miles) | Proposed Status |
|---|---|---|---|---|---|
| 231A | Libby Creek Fisher River A | Between Standard and Miller creeks | Barriered year-long to motor vehicles, including snow vehicles | 0.4 | Gated, construction traffic only; barriered after construction |
| 4782A | Standard Creek - Miller Creek A | Between Standard and Miller creeks | Barriered year-long to motor vehicles, including snow vehicles | 1.4 | Gated, construction traffic only; barriered after construction |
| 5326 | Standard Creek - Miller Creek Oldie | Between Standard and Miller creeks | Barriered year-long to motor vehicles, including snow vehicles | 0.7 | Gated, construction traffic only; barriered after construction |
| 99830 | West Fisher 99830 | On Plum Creek land 1 mile west of U.S. 2 | Barriered | 0.2 | Gated, MMC and Plum Creek traffic only |

#### 2.11.3.2 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the modifications of Alternative C incorporated. BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B. Most construction activity would be contained in the 150-foot right-of-way (Figure 44) with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along most of the alignment (Figure 44). The right-of-way would be 100 feet and the clearing width would be 150 feet in steep areas 2 miles west of U.S. 2 where steel monopoles would be used. In areas adjacent to core grizzly bear habitat, MMC would use a helicopter to clear timber, reducing the need for access road (Figure 45). Helicopter landing sites would generally be on roads (Figure 45).

#### 2.11.3.3 Line Stringing

A helicopter would be used for line stringing in Alternative E.

### 2.11.4 Other Modifications

Modifications described in Alternative 3 for the mine or Alternative C for the transmission line (*e.g.*, cultural resource, wildlife, plant, and wetland surveys; wildlife mitigation; seed mixtures (Table 18); revegetation success; and weed control) would be implemented in Alternative E.

## 2.12 Forest Plan Amendment

Each mine and transmission line alternative would require an amendment to the KFP in order for the alternative to be consistent with the KFP. The amendment would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 and Forest Service

Manual 1921.03. The analysis disclosed in this EIS satisfies the requirements for an evaluation for the amendment.

### 2.12.1 Mine Facilities

In the 1993 ROD approving the lead agencies' preferred alternative for Noranda's proposed Montanore Project, the KNF amended the KFP and reallocated an area surrounding the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site to Management Area 31 (MA 31). MA 31 is designed to accommodate the activities associated with mineral development on the KNF (USDA Forest Service 1987). Because of improved mapping capabilities between 1993 and 2007 and a slight change in the Little Cherry Creek Tailings Impoundment design from that approved in 1993, all areas currently proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Tailings Impoundment Site were not previously reallocated to MA 31. In mine Alternatives 2, 3, and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of the selected plant site, the tailings impoundment, and LAD Areas 1 and 2 that currently are not MA 31. In addition, a proposed road and facility corridor that would cross MA 13 (Designated Old Growth) would be reallocated to MA 31. This amendment would apply only to National Forest System lands disturbed by any mine alternative, and would not apply to private lands affected by the mine alternatives. The effects of the amendment are discussed in section 3.14.4, *Environmental Consequences* in the *Land Use* section. Maps showing existing MAs and the proposed reallocation are available at the KNF.

### 2.12.2 230-kV Transmission Line

In the 1993 ROD approving the lead agencies' preferred alternative for Noranda's proposed Montanore Project, the KNF amended the KFP and reallocated areas crossed by the transmission line classified as corridor avoidance areas (224 acres) to Management Area 23 (MA 23). MA 23 is designed to accommodate the activities associated with electrical transmission corridors on the KNF (USDA Forest Service 1987). Because of improved mapping capabilities between 1993 and 2007 and slight changes in the North Miller Creek transmission line alignment from that approved in 1993, all areas currently proposed for disturbance by MMC's proposed transmission line alignment classified as corridor avoidance areas were not reallocated to MA 23. In transmission line Alternatives B, C, D, and E, the KNF would amend the KFP by reallocating certain areas within a 500-foot corridor of the selected 230-kV transmission line on National Forest System lands as MA 23. This amendment would apply only to certain National Forest System lands currently not MA 23 disturbed by any transmission line alternative, and would not apply to private lands crossed by the transmission line alternatives. The effects of the amendment are discussed in section 3.14.4, *Environmental Consequences* in the *Land Use* section. The amendment would apply to the following MAs if crossed by the transmission line under the conditions described:

- MA 10 and 11 if the proposed corridor was within grizzly bear Management Situation 1 or 2 (see section 3.24.5.3, *Grizzly Bear*)
- MAs 2, 6, 12, 13, and 14

The KFP requires wildlife habitat and security be maintained in MAs 15, 16, 17, and 18 by limiting open road density (ORD) to less than or equal to 3 miles per square mile. ORD in MAs 15, 16, 17, and 18 is currently greater than the standard in the Crazy Planning Subunit (PSU), which is a KNF planning area potentially affected by the proposed project. In transmission line

Alternatives B, C, D, and E, the KNF would amend the KFP by allowing the ORD to exceed the KFP standard in the Crazy PSU during and after the project.

## 2.13 Alternatives Analysis and Rationale for Alternatives Considered but Eliminated

### 2.13.1 Development of Alternatives

Alternatives were developed based on requirements for alternatives under regulations implementing NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the lead agencies separated the proposed Montanore Project into components. *Components* are discrete activities or facilities (*e.g.*, plant site or tailings impoundment) that, when combined with other components, form an alternative. Options were identified for each component. An *option* is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as paste tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. The lead agencies considered options for the following project components:

- Underground mine
- Plant Site and adits
- Tailings impoundment
- LAD Areas
- Access road
- Transmission line

The lead agencies reviewed potential impoundment sites and other alternative components that are described in the following section. The lead agencies' alternatives analysis reviewed the past alternatives analyses efforts, including the KNF's Mineral Activity Coordination Report (the MAC Report) on mineral activity in the Cabinet Mountains (KNF 1986), and analyses conducted by prior project owners as part of the project planning process. As discussed in Chapter 1, the Forest Service, the Montana Department of Health and Environmental Sciences, the DNRC, and the DSL (DEQ's predecessor state agency) prepared a Draft (1990), Supplemental Draft (1991), and Final EIS (USDA Forest Service *et al.* 1992) on the Montanore Project as proposed by Noranda. The 3.5-year environmental review process culminated in 1993 after the KNF and the DSL issued their Records of Decision on the mine, and the Montana Board of Natural Resources and Conservation issued a Certificate of Environmental Compatibility and Public Need, selecting a transmission line alternative similar to that proposed by MMC. The lead agencies' analysis of alternatives considered but eliminated from detailed analysis is discussed in the Final EIS completed in 1992.

The lead agencies completed an alternatives analysis for the Rock Creek Project, a proposed copper-silver mine near Noxon, Montana similar to the proposed Montanore Project, and disclosed the analysis in an Final EIS (USDA Forest Service and DEQ 2001). The Rock Creek Project would mine the same geologic formation (Revett Formation) as the proposed Montanore Project. For the Rock Creek Project, the lead agencies considered many of the same alternatives

considered in the 1992 Final EIS for the Montanore Project. Where applicable, the lead agencies' analysis of the same alternatives discussed in this section is summarized, and the analysis associated with the Rock Creek Project is incorporated by reference (USDA Forest Service and DEQ 2001). The KNF's MAC Report, analyses conducted by prior project owners, the 1992 Montanore Project Final EIS analysis, and the 2001 Rock Creek Project Final EIS analysis are summarized under section 2.13.3, *Prior Environmental Analyses*, following the lead agencies' analysis conducted for this EIS. The past alternatives analysis was updated during the preparation of this EIS. The updated lead agencies' analysis is discussed in section 2.13.2, *2005-2007 Alternatives Analysis.*

### 2.13.1.1 Regulatory Changes

Since the 1992 Final EIS was issued, a number of regulatory changes occurred. The KNF also has amended the KFP to accommodate the original Montanore Project and other changes to the KFP. The lead agencies' alternatives analysis conducted for MMC's proposal incorporated these changes. The lead agencies evaluated potential sites for a tailings impoundment within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek. Sites outside a 10-mile radius were not considered practicable because of long tailings transport distances, large elevational differences between the mill and the impoundment, and potential crossing of perennial streams. The resources affected by the regulatory changes within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek are discussed briefly in the following sections.

#### *2.13.1.1.1 Inland Native Fish Strategy*

In 1995, the KNF amended the KFP to adopt the Inland Native Fish Strategy (INFS) (USDA Forest Service 1995). INFS established stream, wetland, and landslide-prone area protection zones called RHCAs, and set standards and guidelines for managing activities that potentially affect conditions within the RHCAs. Standard widths for defining interim RHCAs were based on four categories of streams. For example, for fish-bearing streams, which comprise nearly all the streams in the Montanore Project analysis area, the interim RHCAs consist of the outer edge of the 100-year floodplain, the outer edge of riparian vegetation, the distance equal to the height of two site-potential trees, or 600 feet, including both sides of the stream channel, whichever is greater. INFS also established RMOs that provide guidance with respect to key habitat variables. Section 3.6, *Aquatic Life and Fisheries* discusses INFS and RHCAs in greater detail. RHCAs in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek are shown in Figure 46. Although RHCAs were not established when the 1992 Final EIS was completed, both the MAC Report and the 1992 Final EIS analysis considered effects on streams and their associated habitats as important resources in facility siting.

#### *2.13.1.1.2 Grizzly Bear*

The Montanore Project analysis area is within the Cabinet-Yaak Grizzly Bear Recovery Zone. In 2004, the USDA Forest Service issued a ROD on forest plan amendments in the Idaho Panhandle, Kootenai, and Lolo National Forests for motorized access management within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones (USDA Forest Service 2004). The KFP amendment provided motorized access and security guidelines for the grizzly bear. In 2006, a federal district judge set aside the Forest Plan Access Amendment EIS and ROD. Currently, grizzly bear standards are established by: the KFP; consultations since 1987, including the 1995 Amended Biological Opinion and Incidental Take Statement on the 1987 KFP (USFWS 1995); and the Selkirk/Cabinet-Yaak Grizzly Bear Areas Interim Access Management Rule Set from December 1, 1998 (IGBC 1998). Several new analyses included in the KFP Access Amendment are

considered best science applicable to the Montanore Project (Wakkinen and Kasworm 1997; Johnson 2007), and are explained in section 3.24, *Wildlife Resources*.

Standards for core grizzly bear habitat were established in the Selkirk/Cabinet-Yaak Grizzly Bear Areas Interim Access Management Rule Set from December 1, 1998. Core grizzly bear habitat is defined as an area of high quality habitat within a Bear Management Unit that contains no motorized travel routes or high-use trails. Core areas do not include any gated or restricted roads, but may contain roads that are impassable due to vegetation or barriers. Section 3.24, *Wildlife Resources* discusses core grizzly bear habitat in greater detail. Core grizzly bear habitat in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek was considered during the evaluation of alternatives, along with lynx (Figure 46). Grizzly bear habitat is shown on Figure 90.

##### *2.13.1.1.3 Lynx*

In 2000, the USFWS listed the lynx as a threatened species. The KFP has been amended to incorporate standards and guidelines for lynx management established in the Northern Rockies Lynx Management Direction adopted in March 2007 (USDA Forest Service 2007a). Section 3.24, *Wildlife Resources* discusses lynx habitat in greater detail. Lynx habitat in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek was considered during the evaluation of alternatives (Figure 46). Lynx habitat is shown on Figure 91.

##### *2.13.1.1.4 Bull Trout*

In 1998, the USFWS listed the bull trout as a threatened species and in 2005 designated critical habitat in five streams in the project area: Libby Creek, Poorman Creek, Ramsey Creek, Rock Creek, and West Fisher Creek. Section 3.6, *Aquatic Life and Fisheries* discusses bull trout in greater detail. Bull trout are found in Libby, Ramsey, Poorman, Bear, East Fork Rock, and Rock creeks in the mine area, and in the Fisher River and West Fisher and Standard creeks along the transmission line alternative corridors (Figure 46).

##### *2.13.1.1.5 Roadless Areas*

Inventoried roadless areas (IRAs) have attributes similar to designated wilderness, such as natural integrity and appearance, opportunities for solitude, and primitive recreation opportunities. IRAs are areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, and any subsequent update or revision of those maps through the land management planning process. The 2000 Roadless Area Conservation Final EIS identified the Barren Peak Inventoried Roadless Area, which is within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek. It is Forest Service policy to preserve roadless characteristics (see Forest Service Manual §1920). Inventoried roadless areas are discussed in section 3.23, *Wilderness and Inventoried Roadless Areas*. Other land use restrictions in the Montanore Project analysis area are CMW and the Cabinet Face East Roadless Area (Figure 46), which were considered in the 1992 analysis.

##### *2.13.1.1.6 Water Quality*

###### Nondegradation

Section 1.3.2.2, *Water Quality-Related Approvals* discusses previous water quality related approvals associated with the Montanore Project. Pursuant to the 1971 nondegradation statute and regulations then in effect, Noranda submitted a "Petition for Change in Quality of Ambient

Waters" in 1989 to the BHES to request the state's authorization to increase the concentration of select constituents in surface and ground water above ambient concentrations. Noranda submitted supplemental information to support the petition in 1992. Under the 1971 statute, any change in surface or ground water quality above ambient concentrations was prohibited, no matter how small the effect, unless the BHES determined that the changes did not preclude present or anticipated uses of water resources, and were justified as a result of necessary social or economic development.

In response to Noranda's petition, the BHES issued an order in 1992, establishing allowable changes in surface and ground water quality adjacent to the Montanore Project (BHES 1992). The Order established numeric nondegradation limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface and ground water), as well as nitrate (ground water only), and total inorganic nitrogen (surface water only). These nondegradation limits apply to all surface and ground water affected by the Montanore Project and remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992). The Order is presented in Appendix A.

The Montana Water Quality Act requires the DEQ to protect high quality waters from degradation. The current nondegradation rules were adopted in 1994 in response to amendments to Montana's nondegradation statute in 1993 and apply to any activity resulting from a new or increased source that may degrade a high quality water. These rules do not apply to sources, such as the Montanore Project, that received an authorization to degrade prior to the adoption of the 1993 amendments to Montana's nondegradation statute.

## 2.13.2 2005-2007 Alternatives Analysis

### 2.13.2.1 Forest Plan Consistency

#### *2.13.2.1.1 Mine Facilities*

As discussed in section 2.2, *Development of Alternatives,* the lead agencies did not identify an alternative that would be in compliance with all KFP standards. For mine facilities, the operating permit areas of the plant site, the tailings impoundment, and LAD Areas 1 and 2 that currently are not MA 31 would be reallocated to MA 31. In addition, a proposed road and facility corridor that would cross MA 13 would be reallocated to MA 31. Although the KFP was amended in 1992 to accommodate the Montanore Project as then approved, all areas proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Impoundment Site were not reallocated to MA 31 because of improved mapping capabilities and a slight change in impoundment design. The lead agencies did not identify alternative locations for mine facilities that would avoid amending the KFP to accommodate the proposed operating permit areas of plant site, the tailings impoundment, and LAD Areas 1 and 2.

One of the issues discussed in section 2.13.1.1, *Regulatory Changes* is the KNF's adoption of the INFS standards. One of the INFS standards, Minerals Management 3 (MM), prohibits solid and sanitary waste facilities in RHCAs, unless no alternative exists. Section 2.13.2.4, *Tailings Impoundment,* discusses the lead agencies' analysis of alternative tailings disposal methods and locations. Compliance with INFS was a key criterion in the alternatives analysis. To be consistent with INFS standard MM-3, the lead agencies developed Alternatives 3 and 4 to minimize the extent to which RHCAs would be affected. Alternatives that would eliminate all effects to RHCAs were not practicable.

#### *2.13.2.1.2 Transmission Line Facilities*

In the 1992 Final EIS, on-site generation of power was considered in lieu of a transmission line. On-site generation would avoid the need to amend the KFP to accommodate the transmission line. The lead agencies eliminated on-site generation because of high capital costs and the likelihood of additional costs to address environmental concerns, such as air quality (USDA Forest Service *et al.* 1992). On-site generation was eliminated in the current alternatives analysis for the same reasons. It would increase concentrations of priority air pollutants, such as nitrogen and sulfur oxides. The agencies' estimate the capital cost of on-site generation to be $37 million.

Other alternatives that would involve the construction and operation of a transmission line would all cross MAs designated as corridor avoidance areas. The lead agencies did not identify any transmission line alternative that would provide power from the BPA's Noxon-Libby 230-kV transmission line that could avoid MAs designated as corridor avoidance areas.

The lead agencies considered a power source other than BPA's Noxon-Libby 230-kV transmission line. One source would require a new line to the mine from a substation located just north of the town of Libby. The primary advantage of the Libby Creek alignment was that it would follow existing transportation and transmission line corridors over much of its length. The major disadvantages of the Libby Creek alignment were that construction costs would be nearly twice that of several other alignments; operating costs would be substantially higher than several other alignments; and all potential alignments would pass through and adjacent to a much higher population density, affecting substantially more private land than other alignments. It also require amending the KFP where it would cross MAs designated as corridor avoidance areas.

### 2.13.2.2 Underground Mine

As discussed previously, the Corps and the EPA must follow the 404(b)(1) Guidelines (40 CFR 230) in permitting the discharge of dredged and fill material into wetlands and waters of the U.S. The Corps requested that the lead agencies address the Guidelines in their alternatives analysis and consider alternative locations that could reasonably be obtained for the underground mine not presently owned by MMC. The location of the underground mine is determined by the location of mineralized copper-silver resources. The following sections describe the lead agencies' evaluation of alternative copper-silver resources in northwest Montana, consistent with the Corps' purpose and need described in section 1.5.2, *U.S. Army Corps of Engineers*.

The U.S. Geological Survey (USGS) recently completed a review of copper-silver deposits in western Montana and eastern Idaho (Boleneus *et al.* 2005). A stratabound deposit is a mineral deposit that occurs within a specific stratigraphic bed or horizon, but which does not comprise the entire bed. Worldwide, stratabound copper-silver deposits contain 23 percent of all known copper resources and are the second most important source of the metal. These deposits typically consist of disseminated copper sulfide minerals restricted to a narrow range of mineralized layers within a sedimentary sequence. The Rock Creek, Montanore, and Troy deposits, which are currently the most significant undeveloped resources identified in the western Montana copper belt, are also among the largest stratabound copper-silver deposits in North America and contain about 15 percent of the copper in such deposits in North America (Boleneus *et al.* 2005).

The USGS study covered an area of 4,280 square miles of the western Montana copper belt and spanned 100 miles north-south by 85 miles east-west. The study's purpose was to describe the regional stratigraphy, lithologic characteristics, and alteration patterns of the Revett Formation in

relation to the localization of stratabound copper-silver deposits, along with the exploration potential of the region. The USGS used the term "world class deposit" to provide the relationship of the Rock Creek and Montanore deposits to other known stratabound copper-silver deposits in North America. World-class deposits are significant because production from any of them would affect the world's supply-demand relation for the metal. World-class deposits are those that exceed the 90$^{th}$ percentile of discovered metal, and contain more than 2.2 million tons of copper. Only three world-class stratabound copper-silver deposits are found in North America: the Rock Creek and Montanore deposit; Kona deposit and the White Pine deposit in Michigan (Boleneus *et al.* 2005).

According to Boleneus *et al.* (2005), mineral deposits in the Revett Formation are unusual because they are also rich in silver, a characteristic that sets them apart from many other stratabound copper deposits. Individually, the Rock Creek and Montanore deposits are considered world-class silver deposits, and collectively they contain 680 million troy ounces of silver. Such deposits represent a "supergiant" silver deposit, which Singer (1995 as cited in Boleneus *et al.* 2005) defined as the largest 1 percent of the world's silver deposits. The right to mine the Rock Creek deposit is owned by another mining company, and could not be reasonably obtained, used, or managed by MMC. Consequently, the lead agencies did not identify any alternative mineralized resources in northwest Montana that MMC could reasonably obtain.

The Montanore mineral deposit itself is not located within regulated waters of the United States. The deposit outcrops near private land adjacent to Rock Lake, and then dips to more than 3,000 feet underground. The deposit would be mined by underground mining methods, and the mining would not result in the discharge of dredged or fill material into waters of the U.S. It is the location of the ancillary surface facilities, such as the plant site and tailings impoundment, that would result in a regulated discharge. The following sections discuss the alternatives considered but eliminated for those ancillary surface facilities. The analysis includes consideration of areas not presently owned by MMC.

#### 2.13.2.3 Plant Site and Adits

The lead agencies used an iterative process to evaluate plant site and adit options. The lead agencies focused on plant sites on the east side of the Cabinet Mountains. The lead agencies evaluated prior alternatives analyses (see section 2.13.3, *Prior Environmental Analyses*), and concluded that plant sites on the west side of Cabinet Mountains were not available, or did not offer any environmental advantages over plant sites on the east side of Cabinet Mountains.

MMC's proposed plant site location is in upper Ramsey Creek, near the CMW boundary. During an interdisciplinary team meeting in 2006, the lead agencies identified the possibility of locating the plant site in upper Libby Creek to consolidate the disturbances associated with the adits and plant in one drainage. The lead agencies identified the area between the CMW boundary and the confluence of Libby and Howard creeks as possible sites. By locating the plant site in the Libby Creek drainage, the KNF could change the access of Ramsey Creek Road (NFS road #4781) about 0.5 mile west of the junction with NFS road #6210 and create more core grizzly bear habitat. Figure 90 shows the effect of the Ramsey Creek Road on core grizzly bear habitat.

The lead agencies initially considered three sites along Libby Creek upstream of the confluence of Libby and Howard creeks: 1) on private land at the existing Libby Adit Site, 2) farther up Libby Creek on National Forest System land, but outside of the CMW (the upstream site), and 3) farther down Libby Creek on National Forest System land just west of the Libby Creek

Recreational Gold Panning Area, a popular recreation site (the downstream site). The analysis included consideration of locating adits relative to the plant site. The adit would not necessarily need to be located adjacent to the plant site; a conveyor could convey ore from an adit located separately from a plant site. Regulations of the Mine Safety and Health Administration require that underground mines have two or more separate escapeways to the surface from the lowest level of the mine. The escapeways must be positioned so that damage to one will not lessen the effectiveness of the others. In addition, refuge shelters must be provided within 30 minutes' walking distance of all workplaces for every employee who cannot reach the surface within a time limit of 1 hour.

The Libby Adit has been completed to within 2,000 feet of the ore body, and MMC has received DEQ approval to extend the adit to the ore body and to conduct exploration drilling. (The KNF has not approved the activities described in Minor Revision 06-002.) Connecting the existing Libby Adit with the upstream plant site in Libby Creek or extending the Libby Adit to the downstream site would not be practicable due to grade considerations. Therefore, at each site, the lead agencies evaluated the option of driving one adit for conveyor haulage and return ventilation, while using the existing Libby Adit for workers, materials and intake ventilation. This would save tunneling costs, but also would incur more land disturbance in the Libby Creek drainage. The lead agencies' initial analysis is described in a February 1, 2007 letter report by Agapito Associates, Inc. (Agapito Associates, Inc. 2007a); the report is on file in the agencies' project record. Five combinations of adit locations and plant site locations were considered:

- Option 1: Proposed Ramsey Creek Site—MMC's proposal provides the basis for the comparison of the other alternatives. This would require two new adits to the ore body.
- Option 2a: Upstream Site with Use of the Libby Adit—plant site would be upstream of the Libby Adit Site, using the Libby Adit for workers and materials. A new adit would be needed from the plant site to the ore body, with plant facilities in the upper Libby Creek, and office/warehouse/bath-house facilities at the Libby Adit Site. The Libby Adit would have to be enlarged to about the same size as the new adit (25 feet by 25 feet).
- Option 2b: Upstream Site, Independent of the Libby Adit—plant and office facilities would be consolidated in the upper Libby Creek. Two new adits from the plant site to the ore body would be needed. The existing Libby Adit could be used for supplemental ventilation.
- Option 3a: Libby Adit Site, One New Adit, and Enlargement of the Libby Adit—plant and office facilities would be located at the Libby Adit Site.
- Option 3b: Libby Adit Site, Two New Adits—plant and office facilities would be located at the Libby Adit Site. The existing Libby Adit could be used for supplemental ventilation.
- Option 4a: Downstream Site with Use of the Libby Adit—plant site downstream of the Libby Adit Site, using the Libby Adit for men and materials. This would require one new adit from the plant site to the ore body, with plant facilities in the lower Libby Creek, and office/warehouse/bath-house facilities at the Libby Adit Site. The Libby Adit would have to be enlarged.

- Option 4b: Downstream Site, Independent of the Libby Adit—plant and office facilities would be consolidated downstream of the Libby Adit Site. This option would require two new adits from the plant site to the ore body. The existing Libby Adit could be used for supplemental ventilation.

Ten criteria were used to evaluate each option. The criteria focused on 1) the physical settings of the sites; 2) the relationship between the sites and the ore body, the tailings impoundment, and the transmission line; and 3) the avalanche hazard. The 10 criteria used to evaluate the options were:

- Topography
- Avalanche potential
- Tunnel length
- Transmission line distance
- Slurry line distance
- Slurry line grade and head
- Ventilation distance
- Land disturbance
- Emergency egress
- Conveyor distance and grade

An analysis completed by Agapito Associates (2007a) provides additional discussion of the criteria, weighting approach, and rankings of the options. Agapito Associates concluded that all of the options evaluated are feasible as plant site locations, with Option 2a (the upstream site, using the enlarged Libby Adit for men and materials) having a slightly higher rating. After Agapito Associates concluded that all the options were feasible, the lead agencies considered environmental issues. A site in upper Libby Creek was not evaluated further because of RHCAs, wetlands along Libby Creek, proximity to the CMW, and the adjacent inventoried IRA. A site on private land on the north side of Libby Creek was eliminated from further analysis because the site did not provide sufficient room for all required facilities, given the existing facilities on the site.

The lead agencies completed additional analysis of three other options: 1) a site on private land on the south side of Libby Creek at the Libby Adit Site; 2) a site immediately adjacent to the Libby Adit Site upstream on Libby Creek; and 3) a site slightly west of the downstream Libby Creek site evaluated by Agapito Associates. These sites are shown on Figure 47. Most of the private land south of Libby Creek is very steep, with slopes exceeding 50 percent. Wetlands are found along the less steep ground adjacent to Libby Creek. A site on private land on the south side of Libby Creek at the Libby Adit Site was eliminated from detailed analysis because it did not provide sufficient room to locate the required plant facilities. Siting facilities on the south side was limited by very steep slopes and by wetlands on more gentle slopes. A site adjacent to the Libby Adit Site upstream on Libby Creek was eliminated from detailed analysis because it would affect RHCAs or an IRA. The lower Libby Creek site was retained for detailed analysis because it would accommodate all necessary facilities, and would not affect wetlands, RHCAs or an IRA.

### 2.13.2.4 Tailings Impoundment

#### *2.13.2.4.1 Initial Site Screening*

During an interdisciplinary team meeting in 2006, the lead agencies reviewed the three prior environmental analyses of tailings disposal sites. In the 1992 Final EIS, impoundment sites in Midas Creek, Standard Creek, and Little Cherry Creek were evaluated. The lead agencies concluded that the reasons for eliminating the Midas Creek and Standard Creek sites remained valid. The lead agencies identified the possibility of locating the impoundment site north of Poorman Creek to avoid diversion of Little Cherry Creek, a perennial stream. To evaluate this option, the lead agencies developed six options for an impoundment site between Little Cherry Creek and Poorman Creek (Poulter 2007). Three Poorman options were eliminated because the dam was sited on private land that was not owned by MMC, and that could not be reasonably obtained. Two options were eliminated because they did not have adequate capacity or required large dam volumes. The option retained was subsequently refined and is described in this section.

After a preliminary review of the Little Cherry Creek and Poorman impoundment options, the Corps requested the lead agencies re-evaluate the practicability of impoundment sites evaluated in prior alternatives analyses (see section 2.13.3.2, *Tailings Impoundment Sites*). An alternative is considered practicable if "if it is available and it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes" (40 CFR 230.10(a)(2)). Tailings impoundment site evaluations in prior alternatives analyses were completed using lower impoundment capacity requirements than currently necessary for the Montanore Project. The lead agencies used a capacity requirement of 120 million tons, and either surface disposal, underground backfill, or a combination to match the Little Cherry Creek Tailings Impoundment capacity. At the current project life of 16 years, the Little Cherry Creek Tailings Impoundment has an excess capacity of an additional 3 years of mine production, or 22 million tons (Table 7).

Evaluation criteria differed among the previous analyses and did not reflect all current issues discussed in section 2.13.1.1, *Regulatory Changes*. To address the Corps' comment on the previous analyses, the lead agencies completed an alternatives analysis of all impoundment sites previously evaluated in the MAC Report and by Morrison-Knudsen Engineers, Inc. (MKE) (1988) (Figure 48). MMC's Little Cherry Creek site and the Poorman option developed by the lead agencies were included in the analysis. The impoundment sites would be developed in conjunction with a plant site analyzed in the prior environmental analyses (Figure 48), discussed in section 2.13.3.1, *Plant Sites*.

To standardize disturbance areas for the impoundment sites and allow a comparison of impacts, a 2,000-foot buffer was applied to each impoundment footprint developed for the MAC Report or the MKE analysis. A 2,000-foot buffer was used because the disturbance area for the proposed Little Cherry Creek and Poorman impoundments, which include ancillary facilities, is between 1,500 and 2,000 acres, and a 2,000-foot buffer around impoundment footprints resulted in similar areas for all impoundment sites.

Most of the criteria used in the initial screening analysis (Table 42) have been discussed in the previous section 2.13.1.1, *Regulatory Changes*. Other criteria used were the need for a perennial stream diversion, watershed area, private land, grizzly bear security, and the Libby Mining District. Perennial streams are relatively permanent streams that are likely to support wetland, riparian, and aquatic habitat. Sites not requiring a diversion of a perennial stream generally would

have less effect on aquatic ecosystems than sites that would. The watershed area above the centerline of the dam was used to assess the likely size of diversion structures.

Private land was used as criterion to comply with the 404(b)(1) Guidelines. The Guidelines indicate if a site is otherwise a practicable alternative, an area not presently owned by the applicant that could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered (40 CFR 230.10(a)(2)). In some cases, affected private land was owned by Sterling Mining Company or its affiliated companies on the west side of the Cabinet Mountains, or by Plum Creek on the east of the mountains. Based on correspondence from Sterling Mining Company and its affiliated companies available in the project record regarding the Montanore Project, private land owned by Sterling Mining Company could not be reasonably obtained for tailings disposal purposes for the Montanore Project. Plum Creek plans to sell its non-strategic timberlands, and has sold land in the analysis area. For this reason, the lead agencies considered lands owned by Plum Creek to be reasonably obtainable. It is not known if private land owned by other entities could be reasonably obtained.

Habitat effectiveness is the amount of secure grizzly bear habitat (habitat at least 0.25 mile from open roads, developments, and high levels of human activity during the active bear year) remaining within a BMU after affected areas and Management Situation 3 lands are subtracted from the total habitat in the BMU. The width of the impact buffer applied to affected areas depends on the type of activity, as recommended in the Cumulative Effects Analysis Process (USDA Forest Service 1988a). Reduced habitat effectiveness was calculated for all impoundment sites and represents the reduction in acreage of secure grizzly bear habitat.

Effects on cultural resources were evaluated by determining effects on the Libby Mining District. The Libby Mining District is a historic district eligible for listing in the National Registry of Historic Places. The district is designed to protect cultural resources associated with mining activity in the Libby Creek area between the 1860s and the 1950s.

Sites affecting bull trout habitat or over 3 acres of IRA (Lower Bear, Upper Bear, Lower Midas, Cable, Libby, Lower Standard, Upper Standard, Smearl, and Ramsey, and unnamed sites 14A and 15A) were eliminated from further consideration because sites that did not affect these resources were available. The McKay Creek site with 3 acres of effect on an IRA was retained because the disturbance area used in the initial analysis could be reconfigured to avoid effects to an IRA. The Upper Midas site was eliminated because of impacts to grizzly bear habitat (541 acres of grizzly core habitat and 635 acres of reduced habitat effectiveness), and reasonable alternatives with less impact to grizzly bear were available.

Sites 11A and 12 (site numbers 2 and 3 on Figure 48) were eliminated because they are owned by Sterling Mining Company or its affiliated companies and they could not be reasonably obtained, utilized, expanded, or managed for tailings disposal purposes. Sites 10A and 21 also were eliminated because they would not have had sufficient tailings capacity and would have needed excessive borrow material. The McKay Creek site was eliminated because it would reduce effectiveness of 819 acres of grizzly bear habitat (Table 42), require diversion of two perennial streams, and affect at least 43 acres of wetlands (USDA Forest Service and DEQ 2001).

**Table 42. Initial Screening Analysis of Tailings Impoundment Sites.**

| Source | Site Name or Desig-nation | Site Number from Figure 48 | Water-shed Area (ac.) | Perennial Stream Diversion (yes/no) | Bull Trout Habitat (ft) | Inventoried Roadless Area (ac.) | RHCAs (ac.) | Private Land (ac.) | Old Growth Habitat (ac) | Core Grizzly Bear (ac.) | Reduced Grizzly Bear Habitat Effective-ness (ac.) | Libby Mining District (ac.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| None | Little Cherry (MMC's Proposed Alternative)† | None | 1,247 | yes | 0 | 0 | 253 | 261 | 151 | 4 | 65 | 566 |
| None | Agency Poorman Option† | None | 900 | no | 0 | 0 | 158 | 0 | 154 | 80 | 86 | 424 |
| MAC | 10A | 1 | 996 | no | 0 | 0 | 103 | 1,097 | 0 | 0 | 0 | 0 |
| MAC | 11A | 2 | 1,619 | no | 0 | 0 | 388 | 920 | 0 | 31 | 89 | 0 |
| MAC | 12 | 3 | 656 | no | 0 | 0 | 221 | 577 | 0 | 0 | 49 | 0 |
| MAC | 14A | 4 | 265 | no | 0 | 120 | 146 | 275 | 27 | 43 | 247 | 0 |
| MAC | 15A | 5 | 975 | no | 0 | 565 | 169 | 0 | 137 | 377 | 501 | 482 |
| MAC | 19 | 6 | 1,012 | no | 0 | 0 | 502 | 339 | 428 | 0 | 130 | 1,855 |
| MAC | 21 | 7 | 852 | no | 0 | 0 | 171 | 1,810 | 0 | 0 | 0 | 0 |
| MKE | Cable | 21 | 2,373 | yes | 7,947 | 1,129 | 229 | 0 | 246 | 432 | 1,366 | 264 |
| MKE | Crazyman | 15 | 1,778 | yes | 0 | 0 | 171 | 464 | 242 | 0 | 0 | 0 |
| MKE | Libby | 12 | 4,293 | yes | 12,756 | 1,272 | 435 | 92 | 357 | 582 | 920 | 40 |
| MKE | Little Cherry | 19 | 1,301 | yes | 0 | 0 | 382 | 157 | 357 | 32 | 241 | 1,383 |
| MKE | Lower Bear | 20 | 2,535 | yes | 10,746 | 0 | 345 | 124 | 417 | 13 | 109 | 898 |
| MKE | Lower Hoodoo | 17 | 2,189 | yes | 0 | 0 | 235 | 171 | 164 | 0 | 0 | 91 |
| MKE | Lower Midas | 8 | 3,345 | yes | 1,351 | 0 | 280 | 194 | 272 | 230 | 223 | 331 |
| MKE | Lower Standard | 13 | 3,201 | yes | 5,952 | 998 | 287 | 1 | 0 | 647 | 1,136 | 4 |
| MKE | McKay | 23 | 1,501 | yes | 0 | 3 | 267 | 919 | 0 | 30 | 819 | 0 |
| MKE | Poorman | 18 | 900 | no | 0 | 0 | 215 | 49 | 291 | 87 | 160 | 1,134 |

| Source | Site Name or Desig-nation | Site Number from Figure 48 | Water-shed Area (ac.) | Perennial Stream Diversion (yes/no) | Bull Trout Habitat (ft) | Inventoried Roadless Area (ac.) | RHCAs (ac.) | Private Land (ac.) | Old Growth Habitat (ac) | Core Grizzly Bear (ac.) | Reduced Grizzly Bear Habitat Effective-ness (ac.) | Libby Mining District (ac.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MKE | Ramsey | 10 | 3,408 | yes | 4,429 | 1,249 | 337 | 0 | 450 | 516 | 1,533 | 392 |
| MKE | Smearl | 16 | 2,139 | yes | 0 | 430 | 286 | 335 | 47 | 394 | 1,268 | 64 |
| MKE | Upper Bear | 22 | 3,063 | yes | 13,640 | 1,415 | 326 | 0 | 321 | 463 | 772 | 223 |
| MKE | Upper Hoodoo | 14 | 1,385 | yes | 0 | 0 | 97 | 0 | 115 | 0 | 0 | 0 |
| MKE | Upper Midas | 9 | 2,136 | yes | 0 | 0 | 180 | 0 | 273 | 541 | 635 | 42 |
| MKE | Upper Standard | 11 | 2,352 | yes | 5,435 | 887 | 262 | 33 | 0 | 566 | 1,049 | 50 |

†Based on proposed disturbance area.

Source: GIS analysis by ERO Resources Corp. using KNF data.

The MAC impoundment site 19 and MKE (1988) Poorman Creek sites overlapped considerably and were replaced by the Alternative 3 Poorman tailings impoundment option developed by the lead agencies. Similarly, the MKE (1988) Little Cherry Creek impoundment site was replaced by MMC's proposed Little Cherry Creek Impoundment.

#### *2.13.2.4.2 Detailed Site Screening*

After initial screening, five impoundment locations were analyzed further: Crazyman, Lower Hoodoo, Upper Hoodoo, Little Cherry, and Poorman. The lead agencies developed conceptual impoundment layouts for the Crazyman and Hoodoo sites based on a 120-million-ton tailings capacity. The two locations in Hoodoo Creek either did not have sufficient capacity or required very large dams and were dismissed from further evaluation. The three sites evaluated further were Little Cherry Creek (MMC's proposal), Poorman, and Crazyman Creek (Figure 49). Features and resource impacts of the three tailings impoundment sites are summarized in Table 43. Impacts are based on the impoundment and dam footprints and not the disturbance area used in the initial screening.

The Little Cherry Creek Tailings Impoundment is described in Alternative 2. It would cover 647 acres and have a 310-foot-high dam. A Crazyman Creek Tailings Impoundment would have a smaller impoundment area and greater dam height than the Little Cherry Creek and Poorman tailings impoundments, disturbing 343 acres and with a maximum dam height of 680 feet. Both the Little Cherry Creek and Poorman sites would have much larger dam volumes than the Crazyman Creek site because of longer dam lengths (10,650 to 11,150 feet) compared to 2,200 feet for Crazyman Creek. Borrow areas would be needed for the Little Cherry Creek and Poorman sites to provide the needed volume.

The Crazyman Creek site would require larger and more diversions. The watershed area for the Crazyman Creek site would be the largest (1,460 acres), and would require a permanent diversion channel larger than that proposed for the Little Cherry Creek site. Two diversion channels would be needed at the Crazyman Creek site, both 12,000 feet long. The Poorman site would have the smallest watershed area, and would not require a permanent diversion channel.

Tailings pipelines to the Crazyman Creek site would be longer than to the other two sites, with total pipeline lengths ranging from 11.6 miles to the Crazyman Creek site to 4.6 miles to the Poorman site. The pipelines to the Crazyman Creek site from a Libby Plant Site would cross five perennial stream crossings: Libby Creek twice, Ramsey Creek, Midas Creek, and Hoodoo Creek. Ramsey Creek and Poorman Creek would be crossed by pipelines to the other two impoundment sites.

Four criteria were used to evaluate effects on hydrology and fisheries: perennial streams, bull trout habitat within and below the impoundment, and RHCAs. Both the Little Cherry Creek and Crazyman Creek sites would require a diversion structure to divert a perennial stream, while the Poorman site would not. The Little Cherry Creek impoundment would fill 1.7 miles of Little Cherry Creek and the Crazyman Creek impoundment would fill 3.0 miles of Crazyman Creek and tributaries. The Poorman impoundment would fill 1.3 miles of intermittent channels that have some perennial flow. None of the three sites would affect a stream occupied by bull trout. The amount of critical bull trout habitat below each impoundment would be similar, ranging from 9.5 miles in the Crazyman Creek site to 10.7 miles in the Poorman site. The Little Cherry Creek site would have the greatest effect on RHCAs (168 acres); some riparian habitat occurring on private land also would be affected. Effects on RHCAs from Poorman (103 acres) and the Crazyman

Creek sites (85 acres) would be less. Little Cherry Creek is a fish-bearing stream with a population of redband trout, a Forest sensitive species. The streams at the Poorman and Crazyman Creek sites are not fish-bearing streams.

**Table 43. Comparison of Features and Resource Impacts of Three Tailings Impoundment Sites.**

| Criteria | Impoundment Option | | |
|---|---|---|---|
| | Little Cherry Creek | Poorman | Crazyman Creek |
| **Engineering/Geotechnical** | | | |
| Impoundment area (acres) | 647 | 675 | 343 |
| Dam height (feet) | 310 | 320 | 680 |
| Maximum crest length (feet) | 11,150 | 10,650 | 2,200 |
| Watershed area (acres) | 1,290 | 910 | 1,460 |
| Number of diversion channels | 1 | 0 | 2 |
| Length of diversion channels (feet) | 10,800 | 0 | 12,460 |
| Stream crossing by tailings pipelines[†] | 2 | 2 | 5 |
| Tailings pipeline length (miles)[†] | 6.4 | 4.2 | 11.6 |
| **Wildlife** | | | |
| Grizzly bear core (acres) | 0 | 0 | 0 |
| Reduced grizzly bear habitat effectiveness (acres)[‡] | 65 | 86 | 0 |
| Old growth habitat (acres) | 119 | 117 | 127 |
| Lynx habitat (acres) | 405 | 362 | 0 |
| Elk security habitat (acres) | 0 | 0 | 0 |
| Moose winter range (acres) | 647 | 675 | 343 |
| **Hydrology/Fisheries** | | | |
| RHCAs (acres) | 168 | 85 | 103 |
| Streams filled by impoundment<br>Perennial (miles)<br>Other streams (miles) | <br>1.7<br>0.0 | <br>0.0<br>1.3 | <br>3.0<br>0.0 |
| Occupied bull trout habitat within impoundment footprint (feet) | 0 | 0 | 0 |
| Critical bull trout habitat below impoundment (miles) | 10.6 | 10.7 | 9.5 |
| **Other** | | | |
| Libby Mining District (acres) | 638 | 675 | 0 |
| Inventoried roadless area (acres) | 0 | 0 | 0 |

[†]From the Libby Plant Site
[‡]From Table 42 and based on the disturbance area (Little Cherry Creek and Poorman sites) or buffer area (Crazyman Creek site)
The length of critical bull trout habitat was calculated from dam to the Kootenai River.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Effects on wildlife were evaluated by considering important grizzly bear, lynx, elk, and moose habitats. Old growth forest provide habitat for a variety of wildlife and aquatic species. None of the three sites would affect core grizzly bear or elk security habitat. The Little Cherry Creek and Poorman sites are within the grizzly bear recovery zone and would reduce grizzly bear habitat effectiveness (Table 42). The Crazyman Creek site is outside of the grizzly bear recovery zone and would not reduce grizzly bear habitat effectiveness (Table 42). All three impoundments would affect similar amounts of old growth. Impacts on lynx habitat would be similar for the Little Cherry Creek and Poorman sites (362 to 405 acres), while no lynx habitat would be affected by the Crazyman Creek site. Effects on moose winter range would be greatest at the Poorman site (675 acres), followed by the Little Cherry Creek site (647 acres), and the Crazyman Creek site (343 acres).

The Little Cherry Creek and Poorman sites would have similar impacts on the Libby Mining District (638 acres and 675 acres, respectively). The Crazyman Creek site would not affect the district. None of the impoundments would affect IRAs.

The lead agencies retained the Little Cherry Creek and Poorman sites for detailed analysis, and eliminated the Crazyman Creek site from detailed analysis. The Crazyman Creek site would have greater effect on perennial streams than the Poorman site, would require larger and more diversions than the Poorman site, and more stream crossings by tailings pipelines. The Crazyman Creek site did not offer environmental advantages over the Poorman site.

### 2.13.2.5 Backfilling of Tailings

The lead agencies completed an analysis to assess whether it would be feasible to significantly reduce the size of the surface tailings impoundment by placing a portion of the tailings underground as backfill. Secondary objectives were to evaluate if the presence of backfill would (1) have benefits to pillar and roof stability or (2) reduce the potential for surface subsidence (Agapito Associates, Inc. 2008)

Tailings would represent more than 99 percent of the broken rock that would be mined. Therefore, tailings production would be 12,500 tpd initially and ultimately increase to 20,000 tpd, parallel to mine production. The surface tailings impoundment is designed to hold an estimated 120 million tons of tailings. Based on the results of bench-scale flotation tests, the tailings are expected to consist of fine particles with 52 percent finer than 200 mesh [0.074 millimeters (mm)] (MMI 2005a, MMC 2008). This fineness is necessary to liberate the ore from the host rock; this fineness has implications for backfilling feasibility, which are discussed below.

The placement of backfill in underground mines for wall support has a long history. Before the advent of chemical concentration of ores, backfilling was generally limited to waste rock or sand and gravel, and was generally hand-placed in backfilled areas. Backfilling with tailings is a more recent innovation that became popular after the widespread adoption of flotation for base metal concentration in the 1920s and 1930s, which made large quantities of tailings available for backfilling that would otherwise require surface disposal. The lead agencies considered four backfill placement methods commonly used include dry placement, pneumatic placement, hydraulic placement, and placement of a thick slurry or paste. A general discussion of each of these methods and their applicability to the Montanore Project follows.

#### *2.13.2.5.1 Dry Placement of Tailings*

With dry placement of backfill, the tailings are typically transported to the backfilling location by a load-haul-dump vehicle or a haulage truck and spread by a wheel loader. Additionally, the tailings require dewatering to 10 to 20 percent water content prior to transport to minimize spillage. The dewatering process usually requires a two-stage process of thickening followed by pressure filtration.

One drawback to this placement method would be the need for a fleet of dedicated vehicles and operators to place and spread the fill. In the case of Montanore, a single haulage truck would require 30 minutes to travel the 3 miles from the mill to the nearest stope and back, excluding dumping time or delays. Allowing for breaks and shift-change, a single truck could achieve at most 13 to 15 loads per 8-hour shift. Assuming a 40-ton payload truck was employed, a single truck can achieve a production rate of 600 tons per shift or 1,800 tons per day (tpd), thus requiring a fleet of 7 trucks and 21 drivers at the initial 12,500-tpd production level and 12 trucks and 33 drivers at the 20,000-tpd production level. A second serious drawback would be the inability to place the backfill close to the roof and the loss of backfill space as a consequence of the clearances required for truck dumping. Because of the costly dewatering, labor-intensive transportation requirements and the inefficient use of backfilling space, the lead agencies eliminated dry placement of tailings (Agapito Associates, Inc. 2008).

#### *2.13.2.5.2 Pneumatic Transport and Placement (Stowing) of Tailings*

Pneumatic placement of tailings is not common in metal mines, but is discussed because it is appropriate for some applications. Pneumatic stowing uses compressed air to transport dry tailings through pipe to the tailings placement location. As in the case of dry placement, the tailings wouid require dewatering and pressure filtration to reduce the water content.

The main drawbacks to this method are the limited capacity [typically less than 200 tons per hour (tph)]of the blowers used to inject the solids into the transport pipe, the limited distances that materials can be transported, and the large compressed-air volumes necessary for transport (typically 1 to 2 cubic feet of air per cubic foot of material stowed). In addition, the tailings must be transported from the dewatering location to the feeder/blower, which cannot be more than a few hundred feet of the backfill location. Because of the costly dewatering, limited transportation distances, and limited placement rate, the lead agencies concluded pneumatic placement of tailings is not technically applicable to or cost-effective for the Montanore Project (Agapito Associates, Inc. 2008).

#### *2.13.2.5.3 Hydraulic Transport and Placement of Tailings*

Hydraulic placement of tailings is the most common backfilling method. For hydraulic placement, the tailings are initially size segregated by cycloning; sand (coarse) tailings are used as backfill and the fine tailings are typically disposed on the surface. The sand tailings are pumped with water at a solids content of typically 55 to 65 percent by weight. Each ton of backfill solids placed must be transported with 140 to 200 gallons of water. Most of this water must be drained from the backfill.

In cut-and-fill mines using hydraulic placement of tailings, it is common to add cement to the tailings at a 1:6 ratio to the top 6 inches of the fill to stabilize the mucking floor. It is also common for cement to be added to tailings at a 1:10 ratio near the boundaries of stopes where the fill may be exposed by subsequent mining of an adjacent stope. A free-standing fill stable over heights up to 25 feet can also be obtained using cemented tailings at a 1:30 cement:tailings ratio

for the entire mass of fill. In Canadian mines, it is customary to add cement to the bulk tailings at a ratio of 1:30. In Australia, hydraulic tailings backfill is generally uncemented because of the cost (poor availability) of Portland cement (Agapito Associates, Inc. 2008).

As discussed above, considerable quantities of water must be drained from hydraulic backfills. In many cut-and-fill stopes, the backfill material must be drained and compacted sufficiently to allow equipment to operate on its surface in as little as 24 hours to avoid delays to the mining cycle. At other mines, drainage is required to minimize the potential for liquefaction and unplanned mobilization of the fill in the event of a rockburst or other seismic event. A rule of thumb for backfill stability is that the percolation rate through the fill, as measured in a test cylinder of fill material in the laboratory, should not be less than 4 inches/hr. Experience has shown that, for many backfill materials, this percolation rate is difficult to achieve if more than 10 percent of the particles in the fill are finer than 200 mesh; however, tailings containing up to 10 percent finer than 325 mesh (0.053 mm) have been found to drain satisfactorily at some mines. As mill tailings typically contain significantly more than 10 percent particles finer than 200 mesh, the material finer than 200 mesh is removed using cyclones before the fill is transported underground. The overflow from the cyclones (the fines and excess water) is transported to the surface tailings impoundment for disposal (Agapito Associates, Inc. 2008).

With hydraulically transported fill, the distance between the mill and backfill location is not a limiting factor. For most underground mines, the elevation head between the mill and the backfill location reduces pumping requirements. To minimize the potential for sanding out of the solids and plugging the pipe, minimum pipeline velocities of 5 feet per second (fps) and 8 fps are recommended for tailings and sand/tailings mixtures, respectively.

Hydraulic filling could be employed at Montanore, provided that adequate underground drainage capacity is provided. The sand-sized tailings at Montanore are needed for construction of the dam surrounding the surface tailings impoundment. If the sand-sized tailings were not available for dam construction, it would be necessary to supply this material from surface borrow sources at additional cost. Because the sand tailings represent about 90 percent of the material suitable for placement hydraulically, the lead agencies eliminated hydraulic placement as an acceptable option for Montanore (Agapito Associates, Inc. 2008).

##### *2.13.2.5.4 Placement of Tailings as a High-Density Slurry or Paste*

In the 1970s, experiments were performed at several mines in Canada to determine if the tailings transported to and disposed in surface tailings impoundments could be partially dewatered, thereby reducing the water content and increasing the angle of repose. The success of these tests and the adoption of "thickened tailings" disposal led in the 1980s to the concept of tailings being transported underground for backfilling as a high-density slurry or "paste."

With this transport and placement method, the tailings become a high-density slurry with a solids content of 75 percent to 80 percent by weight. The slurry acts as a viscous material, for which a shear stress must be exceeded before the material will flow. The critical shear stress for paste fills typically ranges between 250 and 800 Pascals (Pa) (0.041 to 0.116 psi) (Boger *et al.* 2006 as cited in Agapito Associates, Inc. 2008). Because of the viscous nature of the paste and the large amounts of energy required to transport paste in the turbulent regime, it is customary to transport paste in the laminar flow regime (Paterson 2006). Two other important attributes of paste fill are the fact that the water is bound into the slurry, so that little drainage is required, and the fact that fines removal is not required. It is recommended that the paste should contain at least 15 percent

finer than 20 micrometers (Hassani and Archibald 1998 as cited in Agapito Associates, Inc. 2008). In addition, it is customary to add from 3 percent to 6 percent Portland cement or a mixture of Portland cement and fly ash as a binder. Because of the increased strength and reduced need for water handling, paste fill has been supplanting conventional hydraulically placed backfill at mines that have been designed and commissioned since 1990.

### Effect on Tailings Impoundment Size and Cost

The maximum backfill system capacity of about 6,000 tpd of tailings solids represents 48 percent of the tailings at a production rate of 12,500 tpd and 30 percent of the tailings at a production rate of 20,000 tpd. Assuming a 19-year mine life (MMI 2005a, MMC 2008) and 6,000 tpd of tailings sent underground, the total tailings tonnage sent underground becomes 39.9 million tons. With an estimated 120 million tons of total tailings produced during the life of the mine, this represents a 33 percent reduction in the volume of the tailings impoundment. However, tailings impoundments are usually placed in lifts. A reduction in volume of 33 percent might not result in a reduction in the footprint of the tailings impoundment.

To estimate the change in the footprint of the tailings impoundment, the design of the Little Cherry Creek Tailings Impoundment as proposed by MMI was used (Klohn Crippen 2005; Klohn Crippen 2007). Klohn Crippen estimates that 80 percent of the tailings would be fine tailings and 20 percent would be coarse tailings. Assuming 39.9 million tons of whole tailings were sent underground, 32 million tons of fine tailings would not require surface disposal. Klohn Crippen estimated the surface area versus fine tailings volume at the Little Cherry Creek Tailings Impoundment Site (Klohn Crippen 2007). Eliminating the need for surface disposal of 32 million tons of fine tailings would reduce the fine tailings pond size by 86 acres, or 20 percent of the total fine tailings pond. The footprint of the sand dam also would be smaller. These reduction estimates are a small portion of the 1,928 acres proposed for disturbance at the Little Cherry Creek Tailings Impoundment Site. A reasonable estimate of the reduction in the footprint of the surface tailings is 20 percent and 5 to 10 percent of the total disturbance area of the tailings impoundment and all associated facilities (Agapito Associates, Inc. 2008).

The lead agencies completed a preliminary economic analysis of paste backfilling (Agapito Associates, Inc. 2008). If backfilling were integrated into the mining cycle, the operating cost at Montanore would be comparable to that for a mechanized cut-and-fill mine, and would likely not be economical at Montanore. If delayed backfilling was used that did not interfere with primary mining, the additional operating cost of backfill placement would be incurred. Because of the shallow dip of the Montanore resource, backfilling of a mined-out zone would require a network of placement pipes with frequent valving for flow control. This network would be more complex than the piping networks required in typical cut-and-fill mines and would require additional labor to install it and monitor it during pouring. Therefore, the backfilling cost at Montanore would likely fall in the upper portion of the above cost range indicating that a delayed backfilling operation with independent mining and backfilling would likely not be economical at Montanore. Based on the lead agencies' preliminary economic analysis of incorporating underground backfilling into the Montanore Project, paste backfilling would likely make the project uneconomical. Estimated costs would be substantially greater than the costs normally associated with similar mining projects.

**Effect on Risk of Surface Subsidence**

Placement of tailings underground as backfill would reduce the potential for surface subsidence, but would not reduce the potential for the collapse of the underground workings. Regardless, there is a low probability for surface subsidence without backfill under the current mine plan (Agapito Associates, Inc. 2006). Subsidence is discussed in more detail in section 3.9.3.1, *Subsidence*.

### 2.13.2.6 Land Application Disposal Areas

MMC's proposal is to have two LAD Areas, one along the north side of Ramsey Creek (LAD Area 1) and another between Ramsey and Poorman creeks (LAD Area 2) (Figure 7). Most of LAD Area 1 is in timber harvest areas on slopes generally less than 30 percent. The west side of LAD Area 1 affects the Cabinet Face East IRA, and the south side affects old growth and is on the steep slopes of Ramsey Creek. LAD Area 2 is timber harvest areas on the north and south sides, with old growth in the middle part of the area. The lead agencies considered several alternative locations for the LAD Areas. A potential area near the downstream Libby plant site was either too steep or was old growth. A potential area south of the Little Cherry Creek Tailings Impoundment site and east of NFS road #278 (Bear Creek Road) was also considered. The lead agencies are using this area for the Poorman Tailings Impoundment site in Alternative 3, and as a potential borrow area in Alternative 4. No sites were identified that offered environmental advantages over LAD Area 1. The lead agencies reduced the effects of the LAD Areas by modifying the permit and disturbance areas in Alternatives 3 and 4.

### 2.13.2.7 Access Road

MMC is proposing to use NFS road #278 for access and to convey concentrate to the Libby Loadout. There are four possible routes to provide access to the Libby Creek and Ramsey Creek drainages: NFS road #278 south from U.S. 2 about 10 miles along Big Cherry Creek, NFS road #231 (Libby Creek Road) west from U.S. 2 about 12 miles along West Fisher Creek, NFS road #231 along Libby Creek, and NFS roads #385, #4724, #4780, and #231 up Miller Creek and then into the Libby Creek drainage. The lead agencies eliminated NFS road #231 west from U.S. 2 along West Fisher Creek because it had more stream crossings and would be much longer than the proposed alignment. NFS road #231 along Libby Creek would have more stream crossings and steeper grades than NFS road #278. Greater disturbance than that needed on NFS road #278 would be necessary to make NFS road #231 suitable for access. In addition, two major bridges spanning Libby Creek along NFS road #278 would have to be rebuilt and widened. A segment of this road was moved out of the Libby Creek floodplain several years ago and placed on a very steep hillside to prevent the road from flooding and bridges from being washed out. Widening NFS road #278 to accommodate traffic on the steep hillside would cause a major surface disturbance. The steep hillside alignment has only recently started to stabilize and currently experiences large amounts of rock fall and soil movement during storm events. The use of NFS roads #385, #4724, #4780, and #231 was eliminated because of the length and steep slopes that NFS roads #4724 and #4780 traverse.

### 2.13.2.8 Transmission Line Alignment Alternatives

#### *2.13.2.8.1 2005 Major Facility Siting Analysis by MMC*

In 2005, MMC submitted an application to the DEQ (DNRC's successor under the MFSA) for a MFSA certificate to construct a 230-kV transmission line using the North Miller Creek alignment

approved in 1993 by DNRC. A transmission line alignment analysis was conducted (Power Engineers 2005b). The alignment analysis report discussed all the alternatives considered in the 1992 Final EIS, those analyzed in detail and those eliminated from detailed analysis. The alignment analysis report updated the comparison of the three alignments that were carried forward for detailed analysis: North Miller Creek, Miller Creek, and Swamp Creek. Twenty criteria in six broad categories were used in the comparison of these three alternatives. As discussed in MMC's alignment analysis report, MMC considered the North Miller Creek alternative to be the best of the three alternatives using the report's evaluation criteria. Additional discussion of MMC's evaluation criteria and the alternatives comparison is found in the alignment analysis report (Power Engineers 2005b).

#### *2.13.2.8.2 2005-2007 Lead Agency Alternative Screening*

The KNF and the DEQ used an iterative process to develop alternative alignments for the transmission line and to define the criteria with which to evaluate the alternatives. As part of the initial process, the lead agencies mapped and reviewed numerous transmission line alignments. The alignments reviewed were those identified by MMC, modifications of alignments analyzed by MMC, as well as new alignments identified by the lead agencies. The lead agencies also developed criteria with which to evaluate each alternative.

The lead agencies began the screening analysis with the three alignments analyzed in the 1992 Final EIS, as well as the West Fisher Creek alignment. Subsequently, the alignments were slightly modified to improve the alignment. In response to public scoping comments, the lead agencies identified an alternative alignment of a segment immediately north of the proposed Sedlak Park Substation through Plum Creek Timber Company (Plum Creek) land. The alignment would locate the line east of MMC's proposed alignment to address visibility of the line from U.S. 2 and area residences, create a buffer between residences and the line, create a buffer between the Fisher River and the line, and establish a more direct alignment north of the Sedlak Park Substation. The lead agencies also considered two alternatives that avoided Plum Creek lands along U.S. 2 encumbered by a conservation easement held by the FWP. The following alternatives were evaluated using a number of technical and environmental criteria (Figure 50):

- North Miller Creek (MMC's Proposal)
- Modified North Miller Creek
- Modified Miller Creek
- Modified West Fisher Creek 1
- Modified Swamp Creek
- Olson Creek
- Porcupine Creek
- Modified West Fisher Creek 2

The Modified Swamp Creek alternative was eliminated due to the greater effects on old growth, and the unavailability of replacement old growth in the area. The Modified West Fisher Creek 1 was eliminated because it would be longer and would cross more old growth. Because one MFSA siting criterion prefers the use of public lands over private lands the crossing of more private land by this alignment was also a factor. Although the Olson Creek and Porcupine Creek alternatives would be shorter and cross less private land, these two alternatives were eliminated because they would cross the Barren Peak IRA. The remaining four alternatives were retained for detailed analysis. The lead agencies' analysis of possible transmission line alternatives is described in greater detail in the *Transmission Line Screening Report* (ERO Resources Corp. 2006b).

The lead agencies considered locating the transmission line underground. Underground transmission lines typically have less clearing and do not have the visual impact of the transmission lines and structures. Underground transmission lines would have significantly fewer faults, and fewer voltage sags and fewer short- and long-duration interruptions (Electric Power Research Institute 2006). Digging trenches to bury the lines would require greater construction disturbance and would require more time to install. The need for access roads and the associated surface disturbance would be greater. Except along the drainage bottoms, the analysis area is steep, with slopes greater than 30 percent common. Underground line installation and access road construction on steep slopes would have more environmental impact than above-ground construction. Above-ground access vaults would need to be constructed as well as above-ground structures at line termination points. Vegetation would likely have to be restricted within the right of way to avoid reducing soil moisture that is needed to cool the transmission line. Problems with underground systems also would be more difficult to locate and repair. Underground transmission lines would cost between 1.5 and 5 times the amount required to build an overhead line (Electric Power Research Institute 2006). Locating the transmission line underground was dismissed because of the greater surface disturbance and cost.

## 2.13.3 Prior Environmental Analyses

### 2.13.3.1 Plant Sites

#### *2.13.3.1.1 Mineral Activity Coordination Report*

The primary objective of the MAC Report was to identify reasonable alternatives for locating various facilities associated with the proposed Rock Creek Project and other anticipated mining operations, including Noranda's (now MMC's) Montanore Project. The MAC Report discussed alternatives for locating a mill and tailings impoundment for the Montanore Project on the east and west sides of the CMW. The report was based on general information available at the time. No subsurface site data were available, and the Montanore ore body was considered much smaller than current estimates.

The MAC Report recognized the relationship between mill siting and the location of the ore body, and first evaluated locations for a mill or plant. Criteria used in the MAC Report for mill siting were:

- Within 3.5 miles of the ore body
- At least 25 acres with level terrain, or up to 40 acres on slopes to 20 percent
- Underlain by soils and geology that could reasonably support a mill

Two mill sites on the west side (in the East Fork of Rock Creek or at the confluence of the East and West Forks of Rock Creek), and three mill sites on the east side of the Cabinet Mountains (in upper Libby Creek, Ramsey Creek, and upper West Fisher Creek) were identified for the Montanore ore body. The evaluation of the sites was completed in conjunction with the tailings impoundment sites, discussed in the following section 2.13.2.4, *Tailings Impoundment*. Plant sites evaluated in the MAC report and other prior environmental analyses are shown on Figure 48.

#### *2.13.3.1.2 Montanore Project Owners*

The previous owner of the Montanore mineral rights, U.S. Borax, conducted an initial screening evaluation of six possible plant sites: two in upper East Fork Rock Creek, and one each in East

Fork Bull River, and Ramsey, Poorman, and Libby creeks. Plant Sites in Libby, Ramsey, and Rock creeks seemed feasible (Noranda Minerals Corp. 1989). The six plant sites were evaluated in conjunction with four tailings impoundment sites. Plant Sites in upper East Fork Rock Creek and East Fork Bull River were eliminated because of a lack of suitable impoundment sites (see section 2.13.2.4, *Tailings Impoundment*). The Poorman plant site was eliminated because it did not provide any advantages over sites in Ramsey or Libby creek. Borax evaluated two sites in upper Libby Creek and one site in upper Ramsey Creek (Morrison-Knudsen Engineers, Inc. 1988). One of the Libby Creek sites was inside the CMW. All sites were technically feasible. In 1989 Noranda evaluated one plant site in upper Libby and Ramsey creeks (Morrison-Knudsen Engineers, Inc. 1989b). Criteria were access, slope stability, exposure to rockslides and avalanches, foundation conditions, depth to suitable rock for establishing portals, potential for developing adequate working area, and availability of suitable waste rock disposal areas. Borax concluded the Ramsey Plant Site was preferred because of the lower avalanche hazard and better defined adit portal conditions.

#### *2.13.3.1.3 1992 Final EIS*

Three plant site alternatives were considered in the 1992 Final EIS: Libby Creek near the existing Libby Adit location, Ramsey Creek downstream from the proposed plant site location, and Little Cherry Creek near the tailings impoundment. Alternatives to Noranda's proposed Ramsey Creek plant site, which is the same as MMC's proposed Ramsey Plant Site, were dismissed for a variety of reasons. A site between the Libby Adit and the wilderness boundary was eliminated in the 1992 Final EIS because of a higher avalanche hazard and greater potential impacts to the grizzly bear. Locations in Ramsey Creek downstream of the proposed site were considered and dismissed because impacts to most environmental resources would be similar to the proposed location. A plant site location near the proposed tailings impoundment in Little Cherry Creek would reduce both visual impacts from the CMW and wildlife impacts in the Ramsey Creek drainage. This location was dismissed in the 1992 Final EIS primarily because of safety considerations and cost.

### 2.13.3.2 Tailings Impoundment Sites

#### *2.13.3.2.1 MAC Report*

In the MAC Report, criteria used for siting a tailings impoundment were:

- Within 10 miles of mill sites identified in the study
- At an elevation lower than the mill sites identified in the study with no significant uphill trends in the tailings pipelines
- On gentle terrain (slopes generally less than 10 percent)
- Underlain by soils and geology favorable for impoundment construction and operation
- Avoided areas that required diversion of major streams

For the Montanore ore body, tailings impoundment sites were identified on both sides of the Cabinet Mountains. Nine alternative combinations of mill sites and tailings impoundments were identified. Three sites evaluated on the east side of the Cabinet Mountains were in the Little Cherry Creek drainage, in a tributary of Howard Creek, and in a tributary to Bramlett Creek. Impoundment sites evaluated in the MAC report and other prior environmental analyses are shown on Figure 48. The report recommended that alternatives in the Libby Creek drainage not

be considered in the Rock Creek Project analysis but be considered in any future detailed evaluation for other mines like the Montanore Project. The MAC Report identified and evaluated impoundment sites in Little Cherry Creek and Midas Creek (KNF 1986).

#### *2.13.3.2.2 Montanore Project Owners*

The previous owner of the Montanore mineral rights, U.S. Borax, conducted an initial screening evaluation of possible impoundment sites. Three sites were evaluated on the west side of the Cabinet Mountains, and one site in Little Cherry Creek was evaluated on the east side. The sites on the west side of the Cabinet Mountains, in McKay Creek, Bull River, and Swamp Creek, were eliminated because of technical and environmental concerns. The McKay Creek site was eliminated from further study because it had multiple owners and would require diversion of 12 square miles of drainage. The Bull River site was eliminated from further study because it was in a potential floodplain and for economic reasons. The Swamp Creek site was eliminated from additional study because of the high cost associated with 16 miles of tailings and return water pipelines, and potential hydrologic problems (Noranda 1989; Thompson 1989).

Following the initial screening, MKE indicated that developing either the Poorman site or Little Cherry Creek site for tailings disposal could be costly due to seepage control considerations (Morrison-Knudsen Engineers, Inc. 1988). MKE recommended conducting a reconnaissance on the east side of the Cabinet Mountains to identify potential impoundment site alternatives that could be less costly to develop. In addition, U.S. Borax indicated that a reconnaissance should be made of the upper Libby Creek, west of the wilderness boundary, for a portal and plant site (see the prior discussion of plant sites). In a 1988 study, the following criteria were used to evaluate sites on the east side of the Cabinet Mountains:

- Storage capacity of at least 70,000,000 cubic yards of tailings
- Minimizing impoundment watershed areas
- Minimizing stream diversion requirements

The storage capacity of 70 million cubic yards of tailings was based on initial estimates developed by U.S. Borax. Before the 1988 report was finalized, Borax sold its interest in the project to Noranda. Based on additional evaluation of the ore body, Noranda increased the capacity requirement to 150 million tons in 1988 and then decreased the amount to 120 million tons in 1989. Noranda also requested that MKE review the McKay Creek area, on the west side of the Cabinet Mountains, for a tailings impoundment site. MKE evaluated sites in the following drainages: Standard, Midas, Libby, Ramsey, Cable, Bear, Smearl, Crazyman, Hoodoo, Little Cherry, Poorman, and McKay (Figure 48). In the evaluation of impoundment site alternatives, MKE considered several factors, the most important of which were seepage control, size of dam, and construction material requirements, proximity to a plant site in either upper Libby or Ramsey creek, and watershed area. Except for possibly the McKay Creek site, MKE found that all sites could be designed to store at least 70 million cubic yards of tailings. MKE found that Midas and Standard creek sites were the most acceptable, and recommended further geotechnical investigation of these sites. The other sites had less desirable characteristics.

In 1989, Noranda conducted preliminary geologic and geotechnical investigations on three sites: Midas Creek, Poorman, and Little Cherry Creek (Morrison-Knudsen Engineers, Inc. 1989b). It is not clear why Standard Creek was not investigated further. Criteria used by Noranda for site selection in the 1989 preliminary geologic and geotechnical investigations included:

- Sufficient tailings storage capacity
- Geotechnical characteristics, particularly consideration of subsurface seepage
- Watershed area and stream diversion requirements
- Embankment volume

MKE dismissed the Poorman site from consideration because it lacked sufficient capacity and would require a large volume of earth and rockfill for material balance. In addition, artesian ground water conditions at the site would probably require the installation of pressure relief wells to control uplift pressures in the dam foundation. Noranda found that the Midas Creek site could be developed to store 120 million tons of tailings. The main disadvantage of this site was that the permanent diversion channels would be subject to blockage by slides and debris, which could lead to failure of these channels. The proper performance of these channels would be necessary long term. Failure of the channels would lead to failure of the tailings retention dam by overtopping. Noranda did not consider the Midas Creek site to be economically feasible for tailings impoundment construction. Noranda's 1989 evaluation concluded that the Little Cherry Creek site was the preferred site.

#### *2.13.3.2.3 1992 Final EIS*

In the 1992 Final EIS, the lead agencies reviewed Noranda's analysis and completed an analysis independent of Noranda's. The lead agencies' considered numerous environmental and engineering factors, such as impoundment capacity, dam volume and height, surface water control, pipeline considerations, and environmental resources such as fisheries, wetlands and other waters of the U.S., diversion of perennial streams, and threatened and endangered species. Development of a tailings impoundment and mill site in the East Fork Rock Creek drainage was considered but eliminated. Possible impoundment sites in the Rock Creek drainage either lacked sufficient storage capacity, required excessive borrow amounts, or contained potentially unsuitable foundation soils.

In the 1992 Final EIS, impoundment sites in Midas Creek, Standard Creek, and Little Cherry Creek were evaluated. The lead agencies did not identify an alternative tailings impoundment site that would avoid discharge of dredged or fill materials into waters of the United States. The quantity of proposed discharge, local topography, and drainage patterns precluded such an alternative. All three tailings impoundment alternative sites would affect waters of the U.S. and wetlands. All three sites also would require diversion of a perennial stream.

The lead agencies considered a possible site on Standard Creek because it had sufficient storage capacity, and otherwise met the general criteria required for an impoundment siting. The Standard Creek site would affect more miles of perennial streams and more acres of wetlands than the other two sites. The Little Cherry Creek site would affect fewer miles of perennial streams, but more wetland acres than the Midas Creek site. The Little Cherry Creek site would affect the smallest drainage area of the three alternatives, and would require the least amount of stream diversions. No spillway or dam freeboard would be required for reclamation at Little Cherry Creek. Reclamation of the Midas Creek and Standard Creek impoundments would require routing waters onto the impoundment and over a spillway located along the dam abutment. Considering both environmental and engineering factors, the Little Cherry Creek site was determined to be the most practicable and least environmentally damaging tailings impoundment alternative. In 1992,

the lead agencies dismissed Midas Creek and Standard Creek as alternative tailings impoundment sites from detailed analysis.

### 2.13.3.3 Tailings Disposal Techniques

In the prior environmental analysis of both the Montanore and Rock Creek Projects, several alternative tailings disposal techniques were evaluated but dismissed from detailed analysis (USDA Forest Service *et al.* 1992; USDA Forest Service and DEQ 2001). These alternatives included conventional backfill of tailings into the mine, partial backfill of tailings into the mine using both coarse and fine tailings, and dry storage of tailings.

#### *2.13.3.3.1 Conventional Backfill*

Backfilling of tailings into the Montanore mine was evaluated to determine whether it could be used to reduce the size of the tailings impoundment, and whether its use would be needed to prevent subsidence (collapse) of the surface overlying the mine. Backfilling with tailings has traditionally been used in narrow, steeply dipping mineral deposits for ground support to prevent collapse of workings, provide a platform for miners to reach overlying ore, and maximize ore recovery.

Conventional tailings backfill was dismissed from detailed analysis in 1992 for three reasons. First, the use of coarse tailings for backfill would have required surface excavation of a large amount of borrow to replace the tailings for use in embankment construction. This would have resulted in additional surface disturbance. Second, the need for backfill to further limit subsidence potential was not warranted. In 1992, the lead agencies concluded proper sizing and location of pillars, the sizing of roof spans, and the location of roof horizons should prevent any widespread collapse and consequent subsidence. Finally, conventional backfill would add unreasonable costs to the operation, and may have made the operation economically infeasible. Increased capital and operating costs would have resulted from costs associated with backfilling, inefficiencies in the mining operation, and the increased cost to excavate, haul, and place the replacement borrow material (USDA Forest Service *et al.* 1992).

In the Rock Creek Project EIS, the lead agencies dismissed conventional backfilling from further consideration because a surface impoundment would not be eliminated or reduced in size by many acres. At Rock Creek, designated embankment construction materials would require development of an alternate material source and accompanying disturbance area, and backfilling with whole tailings was not a proven technology at the scale (production rate and volumes) of the proposed project (USDA Forest Service and DEQ 2001).

#### *2.13.3.3.2 Partial Backfill*

Another alternative considered in the 1992 Final EIS was to use non-densified whole (coarse and fine) tailings to partially fill the mine. At Montanore, this would have required mining to begin near the bottom of the deposit working upward. Whole tailings would then be slurried into the empty stopes (mined-out areas) after mining is completed in that area. The tailings would remain as a weak, saturated mass. This method would deposit tailings only in the lower mine portion because placement near and above the underground crusher, haulageways, and adit entrances would pose a hazard to workers and affect ongoing operations.

This alternative was dismissed from further consideration in 1992 because it offered no environmental advantages over the Proposed Action. There was no substantial reduction in the

size of the surface impoundment under this alternative. In 1992, the lead agencies concluded that starting operations in the lower portion of the deposit would significantly add to initial investment costs both in terms of the time delay to delineate the lower end of the ore body, and the cost for developing additional underground workings to access the lower part of the ore body. The lower grade ore in this area may not have generated sufficient revenues to pay for these additional investments (USDA Forest Service *et al.* 1992).

##### *2.13.3.3.3 "Dry" Tailings*

In 1992, the existing filtration methods for creating dry tailings were economical for small-scale operations on the order of hundreds of tons of tailings per day. In 1992, the proposed Montanore Project was planned to process 20,000 tons per day of tailings. The lead agencies eliminated dry tailings in the 1992 Final EIS because of technical and cost constraints (USDA Forest Service *et al.* 1992). In the Rock Creek Project EIS, the lead agencies did not consider dry tailings to be a viable tailings disposal alternative because of technical and operational difficulties that could result from having to mechanically handle large quantities of tailings, the probable need for a backup wet tailings storage, and increased capital and operating costs (USDA Forest Service and DEQ 2001).

#### 2.13.3.4 Access Road

In the 1992 Final EIS, the lead agencies eliminated NFS road #231 from detailed analysis because it would have more stream crossings and have steeper grades than NFS road #278.

#### 2.13.3.5 Transmission Line

In 1992, the KNF and the DNRC considered several sources of power and different transmission line designs, construction methods, and locations. Two alternatives were eliminated from consideration initially due to their excessive costs and infeasibility. Four other alternatives were evaluated further by the lead agencies, but were ultimately eliminated because they were more costly and did not offer any environmental advantages over the alternatives analyzed in detail in the 1992 Final EIS. In 1992, as well as currently, the laws governing siting a major facility such as the proposed 230-kV transmission line allowed the consideration of cost in assessing impacts (75-20-301(1)(c)). The 1992 analysis associated with transmission line is summarized in the following sections (USDA Forest Service *et al.* 1992). Like the previous discussion of prior alternatives analysis associated with the mine facilities, the past alternatives analysis was updated during the preparation of this EIS. The updated lead agencies' analysis is discussed in the previous section 2.13.2.8, *Transmission Line Alignment Alternatives*.

The lead agencies eliminated on-site generation because of high capital costs and the likelihood of additional costs to address environmental concerns, such as air quality. Several power sources on the east side of the Cabinet Mountains were considered to serve the mine. One source would require a new 230-kV line to the mine from an existing substation located just north of the town of Libby. The KNF and the DNRC eliminated the Libby Creek alignment from detailed analysis. The major disadvantages of the Libby Creek alignment were that construction costs would be nearly twice that of several other alignments, operating costs would be substantially higher than several other alignments, and all potential alignments would pass through or adjacent to a much higher population density, affecting substantially more private land than other alignments.

The KNF and the DNRC evaluated a number of options for tapping the area's 230-kV system (USDA Forest Service *et al.* 1992). The lead agencies considered a tap on BPA's Noxon-Libby

230-kV transmission line 7 miles southwest of Pleasant Valley, Montana. This alternative, referred to as Trail Creek, would have required a substation tap on the BPA line in a remote area near the junction of Iron Meadow Creek and the Silver Butte Fisher River. In 1992, this option was not retained by the lead agencies for further detailed study because of its remote location, and environmental concerns about crossing an unroaded area.

The KNF and DNRC evaluated alternatives for the proposed transmission line from a proposed tap site on BPA's Noxon-Libby 230-kV transmission line at Sedlak Park west of Pleasant Valley. Three alignments, Miller Creek, North Miller Creek, and Swamp Creek, were analyzed in detail in the 1992 Final EIS. Two additional alternatives, the West Fisher Creek and Miller Creek/Midas Creek options, were eliminated from detailed consideration in 1992 because they offered no advantages in cost or environmental impact over the alternatives carried forward for detailed analysis.

The West Fisher Creek alignment was eliminated from detailed study because it would be longer than other alignments. The West Fisher Creek alternative would affect more private landowners than other 230-kV alternatives analyzed in detail in the 1992 Final EIS. It also would affect more recreational users due to its location along a major forest access road. The Miller Creek/Midas Creek alignment was eliminated from detailed study because of its greater length and the lack of environmental advantages over other alternatives. In the 1992 Final EIS, the KNF and the DNRC recommended the North Miller Creek alternative as providing the best balance for an alignment, considering the factors used in the 1992 analysis (USDA Forest Service *et al.* 1992).

In the 1992 analysis, the lead agencies considered the use of helicopters to erect the transmission line structures as an alternative to conventional construction methods (USDA Forest Service *et al.* 1992). The lead agencies determined that general use of helicopters in line construction would have little environmental advantage because conventional equipment, such as augers, would be required to excavate foundations for the transmission line structures. Disturbance associated with the access required to move this equipment to each pole location could not be avoided unless more expensive and time-consuming methods (such as hand digging of pole foundation holes) were done. Line maintenance costs also would be increased without ground access to each tower. For these reasons, the lead agencies dismissed this method as a recommended line construction alternative.

#### 2.13.3.6 Joint Venture Mineral Development Combined Mining Operations (Rock Creek Project and Montanore Project)

In the 1992 Final EIS for the Montanore Project, the lead agencies evaluated the potential alternative of combining ASARCO's (now Rock Creek Resources') Rock Creek Project with the Montanore Project (USDA Forest Service *et al.* 1992). A similar analysis was conducted and disclosed in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). In the Montanore Project Final EIS, the lead agencies concluded they had no regulatory authority to require a combined operation.

In the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001), the lead agencies determined that the efficiencies that might be achieved under a combined operation would likely provide for a more cost-efficient operation as compared to two separate operations. The alternative was dismissed for environmental, engineering, and legal reasons (USDA Forest Service and DEQ 2001). If the companies were to develop an operational agreement and propose

a joint operation, the agencies would initiate a NEPA/MEPA review as appropriate to disclose the effects of such a proposal.

## 2.14 Comparison of Alternatives

The alternatives analyzed in this EIS were developed in response to the significant issues identified during scoping. The lead agencies identified seven significant environmental issues to drive development of alternatives and evaluation of impacts (see section 2.1.2, *Issues*). These alternatives are described in detail in this chapter. A detailed discussion of the alternatives' impacts is contained in Chapter 3. The effects of the alternatives are summarized in the *Summary* section of this EIS.

# Chapter 3. Affected Environment and Environmental Consequences

This Chapter describes the environment (including its human elements) in the analysis area and discusses the environmental consequences by resource that may result from implementation of each alternative. It provides the scientific and analytic basis for the comparison of alternatives presented in the *Summary* section of this EIS.

## 3.1 Terms Used in this EIS

### 3.1.1 Direct, Indirect, and Cumulative Effects

Environmental effects can be direct, indirect, or cumulative and long or short in duration. Direct effects are those that are caused by the action and occur at the same time and place. Indirect effects are those that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). The short-term impacts and uses for the mining related aspects of the project are those that would occur during the life of the project. Short-term impacts associated with the transmission line are those that would occur during construction and the 5 years that DEQ would hold the bond for reclamation of transmission line construction-related disturbances. Long-term impacts of the project are those that would persist beyond mine closure and final reclamation.

After mining and milling operations cease, reclamation and closure activities would consist generally of two phases. The first phase would involve the removal of underground and surface facilities, closure of underground workings, and reclamation of surface disturbances in accordance with the approved operating plan. Included in this would be the dewatering and capping of the tailings impoundment as described in section 2.4.3.1.6, *Tailings Impoundment and Borrow Areas*. It is estimated that the dewatering of the tailings impoundment could last from 5 to 20 years, and is assessed in the impact analysis that follows in this chapter.

The second phase would involve long-term maintenance of specific facilities, such as the Libby Adit Water Treatment Plant or the seepage return facilities at the tailings impoundment. MMC would maintain and operate these facilities until water quality standards are met in all receiving waters from the specific discharge. MMC also would continue water monitoring as long as the MPDES permit is in effect. As long as post-closure water treatment operates, the agencies would require a bond for the operation and maintenance of the water treatment plant. The level of human activity associated with facility operation, maintenance, and monitoring is unknown, but has the potential of being a daily requirement and year-round in duration. The length of time that the second phase of closure activities would occur is not known, but may be decades or more.

Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Past and current activities and natural events have contributed to creating the existing condition and trends, as described in the *Affected Environment* sections of this chapter. Additionally, some of these activities may continue to produce environmental effects on issues or resources relevant to the proposal. The list of activities considered in the cumulative effects

analysis was taken from the KNF's Schedule of Proposed Actions and from KNF program managers. Many resources in the KNF are managed by PSUs, which are management areas generally based on fifth-order drainages. Unless otherwise stated, the area encompassing activities included in the cumulative effects analysis for the Montanore Project includes the PSUs potentially affected by the project, namely the Treasure, Crazy, Silverfish, and Rock PSUs. A comprehensive list of individual past and current activities provided by KNF resource specialists is provided in Appendix E. Figure 51 shows activities considered in the cumulative effects analysis.

Activities on public and private lands have been considered. Data on private lands are the best available information derived from landowners and field verification, and are generally more limited than data on public lands. The types of actions (past and current or reasonably foreseeable) analyzed in the cumulative effects analysis can be grouped into four categories:

- Mining Activities
- KNF Land Management Activities
- Private Land Activities
- Other Government Agency Activities

### 3.1.2 Irreversible or Irretrievable Commitment of Resources

As required by NEPA, this section also includes a discussion by resource of any irreversible or irretrievable commitment of resources that would result from implementing the alternatives. An irreversible commitment of resources means that non-renewable resources are consumed or destroyed. These resources are permanently lost due to project implementation. An irretrievable commitment of resources is the loss of resources or resource production, or use of renewable resources, during project construction and during the period of time that the project is in place.

## 3.2 Past and Current Actions

### 3.2.1 Mining Activities

#### 3.2.1.1 Other Minerals Activities

Numerous mining claims are within the Treasure, Crazy, Silverfish, and Rock PSUs, some of which were mined previously, are abandoned, or are active. While many of these claims are for mineral lodes, some are for gravel pits on National Forest System lands that provide mineral material for Forest Service road projects. Also, several Plans of Operation have been approved for stream suction dredging and exploratory digging in these PSUs.

### 3.2.2 KNF Management Activities

#### 3.2.2.1 Bear Lakes Access

The proposed action in the EA completed by the KNF will permit the owners of the Bear Lakes Ranch reasonable access to a cabin on Bear Lakes Ranch. The action proposed by the KNF will permit the owners to use either the Bear Lakes Trail #178 or the Divide Cut-off Trail #63 via the Iron Meadow Trail #113 for horse and pack stock access to the cabin on Bear Lakes Ranch. The

owners of the ranch will then be permitted to use a portion of the non-system trail into Big Bear Lake Basin and construct a new trail to the cabin as designated by the KNF. About 1,000 feet of new trail will be constructed to access the private land. The new construction will involve a limited amount of blasting (*i.e.*, one day involving four to six blasts) and will occur in designated wilderness (USDA Forest Service 2005b).

#### 3.2.2.2 Snowshoe Mine and Snowshoe Creek CERCLA Project

The KNF prepared a Removal Action Engineering Evaluation/Cost Analysis that evaluated removal alternatives for mine waste located within the Snowshoe and Big Cherry Creek drainages on the KNF near Libby (Maxim Technologies 2004). The principal environmental issues at these sites are associated with impacts from historical mining operations. Human health and environmental issues are related to elevated levels of metal contaminants present in mine wastes and contaminants transported in surface water.

Three sites are included in this evaluation: the Snowshoe Mine, Snowshoe Creek, and Big Cherry Millsite. The Snowshoe Mine workings are located 16.5 miles southeast of Libby on patented mining claims. Activities at the Snowshoe Mine have impacted National Forest System lands downstream of the mine site for a distance of 3 miles in Snowshoe Creek, a tributary to Big Cherry Creek (Pioneer Technical Services, Inc. 2005). The preferred alternatives for the Snowshoe Mine and Snowshoe Creek sites include total removal of tailings to an on-site repository. Stabilizing the sites through total removal of tailings and mine waste, stream reconstruction, backfilling/soiling, and revegetation will reduce erosion of waste at the sites. Any residual contaminants left in native soil beneath excavated tailings areas will be covered and vegetated. Road reconstruction was completed in 2007 and streamside cleanup will be completed in 2008 or 2009.

#### 3.2.2.3 Fuels and Timber Management

A list of past precommercial thinning, prescribed burns, fuels reduction treatments, tree planting, and timber sales activity is provided in Appendix E.

#### 3.2.2.4 Road Construction, Reconstruction, Maintenance

Road construction in the Montanore cumulative affects analysis area is shown by decade on Figure 52. Routine road maintenance is likely to occur as needed on existing roads in the analysis area. The roads most likely to receive maintenance are those open to vehicle traffic.

#### 3.2.2.5 Weed Control

Weed control is ongoing within the analysis area under the KNF Forest Invasive Plant Management Final EIS and associated ROD (KNF 2007a). Under the plan, the KNF will use additional types of herbicides (all water soluble); treat up to 94,000 acres of noxious weeds; adopt an integrated weed management strategy; and broaden noxious weed herbicide control methods to include the use of aerial herbicide applications. Noxious weed management activities also may occur on Plum Creek lands or other private property. A complete inventory of noxious weed management activities is provided in Appendix E.

#### 3.2.2.6 Public Activities Likely to Occur on KNF Lands

Firewood cutting is likely to continue to occur along open roads. Recreational use of the area also will continue and includes driving open roads, snowmobiling, hunting, hiking, berry picking, and other activities. Firewood gathering permits issued from 1985 to 2006 are listed in Appendix E.

One outfitter holds a permit for hunting and trail rides within the Silverfish PSU. A hunting camp is permitted near but outside the CMW. This camp is accessed by a trail using foot or saddle and pack stock.

### 3.2.3 Private Land Activities

#### 3.2.3.1 Libby Creek Placer Timber Harvest

Libby Creek Placer Company will remove 50,000 to 100,000 board feet of timber annually (except in 2007) on the Libby Placer property. About 20 loads or less are expected to be removed from the property per year for 3 years beginning in 2007.

#### 3.2.3.2 Avista-funded Bull Trout Recovery Activities

Avista Corp. is funding ongoing fish trapping/monitoring activities in Rock Creek and East Fork Bull River. Both drainages have screw traps for capturing out-migrating juvenile trout. In the East Fork Bull River, Avista and FWP will be implementing a non-native suppression program that involves active and passive methods to remove and exclude non-native fish from the river. Fish will be moved to other areas of the Bull River. Channel restoration in the East Fork Bull River occurred in 2007. Avista funded the KNF to complete 1,100 feet of channel restoration to route the stream back into a historical channel to avoid a newly created chronic sediment source. Most of the work will occur on private land.

### 3.2.4 Other Government Agency Activities

#### 3.2.4.1 FWP Grizzly Bear Management Plan

In response to increasing numbers and expanding distribution of grizzly bears in parts of western Montana, FWP adopted the Grizzly Bear Management Plan for Western Montana (Dood *et al.* 2006). The plan was developed to address the future of grizzly bear management in 17 counties in western Montana outside of the Greater Yellowstone Area. The plan focuses on grizzly bear populations or potential populations in the Northern Continental Divide Ecosystem (NCDE), Cabinet-Yaak Ecosystem, and Bitterroot Ecosystem, as well as surrounding areas. The 10-year plan is being implemented in accordance with and in cooperation with the Grizzly Bear Recovery Plan, to the extent possible under constraints of the ESA until the grizzly bear is delisted. Current approaches to land management, wildlife management, and recreation within the NCDE appear to be providing the conditions needed to establish a population of bears outside the recovery zone. According to the plan, recovery to date in the Cabinet-Yaak Ecosystem has been slow and tenuous, and recovery has yet to begin in the Bitterroot Ecosystem. The purpose of the plan is to provide strategies that can be adapted to local and regional conditions. Issues addressed in the plan include conflict management, habitat monitoring and management, population monitoring and management, harvest management, enforcement, education and public outreach, future research, costs and funding, and expanded local involvement.

Management approaches and guidelines are outlined for each ecosystem. The focus for the Cabinet-Yaak Ecosystem is accelerated recovery through rapid augmentation and reduced human use mortality of the grizzly bear population. In cooperation with USFWS and the Forest Service, 10 to 15 sub-adult male or female, or appropriate adult females, will be relocated from other areas (Yellowstone, NCDE, or Canada) within the next 3 to 5 years. At the present time, the emphasis for augmentation will be on females because it is believed that there are still sufficient males within the area to support recovery. No conflict or habituated and/or food conditioned bears will be used for augmentation, and released animals will be intensively monitored. After the initial effort, the effectiveness of the program will be evaluated and the successes and potential problems of the program will be identified. Programs will be developed to reduce human-caused mortality and to improve or create population linkages, especially between the Cabinet and Yaak populations.

#### 3.2.4.2 DNRC Habitat Conservation Plan

The DNRC Trust Land Management Division (TLMD) is developing a voluntary multi-species habitat conservation plan (HCP) in partnership with the USFWS. The HCP intends to sustain DNRC management practices over time while conserving habitat for five fish and wildlife species, three of which are listed under the ESA. The HCP is being prepared to meet regulatory compliance with Section 10(a)(1)(B) of the ESA. Section 10 provides a regulatory mechanism to allow for the incidental take of federally endangered and threatened species of wildlife by private interests and non-federal government agencies during lawful land practices. The HCP permit period is proposed to extend 50 years and covers forest management activities on classified forested state trust lands that provide habitat for species currently listed or having the potential to be listed under the ESA. Those species include: grizzly bear, Canada lynx, bull trout, westslope cutthroat trout, and redband trout. Activities covered by the HCP will be timber management activities, road construction, reconstruction, maintenance, and use and associated gravel quarrying for forest road surface materials, and grazing. One state land parcel subject to the HCP is found along the West Fisher Creek transmission line alternative.

#### 3.2.4.3 FWP-Plum Creek Conservation Easement

In 2003, Plum Creek initiated a 7-year transaction to sell a conservation easement to the FWP on 142,000 acres in northwest Montana. The Plum Creek Conservation Easement is discussed in section 3.14, *Land Use* and shown on Figure 77.

## 3.3 Reasonably Foreseeable Future Actions

### 3.3.1 Mining Activities

#### 3.3.1.1 Rock Creek Project

The Rock Creek Project is an underground copper and silver mine and mill/concentrator complex near Noxon, in Sanders County, Montana. The KNF and the DEQ issued a joint ROD on the project in 2001 (USDA Forest Service and DEQ 2001) and the KNF issued a new ROD in 2003 (USDA Forest Service 2003a) following a revised USFWS BO (USFWS 2003a). The Final BO on the project was issued in 2006 (USFWS 2006). A supplement to the Final BO was issued in 2007 (USFWS 2007a).

The project will include relocation of the lower portion of NFS road #150 and the construction of a mill/concentrator for ore processing, mine waste disposal facilities, various pipelines and access roads, a 230-kV transmission line and associated substation, a rail loading area for transportation of concentrate, and water treatment facilities. The permit area for the project will be 1,560 acres (749 acres of private and 811 acres of National Forest System lands). The project will disturb 482 acres, of which 140 acres will be National Forest System lands, and reduce grizzly bear habitat effectiveness on an estimated 7,044 acres during construction and 6,428 acres during operations. The life of the Rock Creek Project is anticipated to be 35 years. The Rock Creek ore deposit is located beneath and adjacent to the CMW. The ore deposit, mill, and other facilities will be located in the Kaniksu National Forest, which is administered by the KNF in Montana. Access to the proposed project site will be via Montana Highway 200, then 6 miles north on NFS road #150, or the Rock Creek Road.

An evaluation adit will be constructed above the West Fork Rock Creek off of NFS road #2741 near the CMW to gather additional data and to provide ventilation during mining. Support facilities will be constructed, including a temporary wastewater treatment facility to handle water from the evaluation adit prior to discharge to the Clark Fork River or approved percolation basins.

The underground mining operation will use a room-and-pillar mining method. The mineralized zone under the CMW will be accessed through twin adits driven from outside the CMW. A fourth adit may be constructed for ventilation intake with a portal in the CMW if needed. Ore concentrate produced during the milling process will be transported from the mill to the rail loading area via pipeline and then shipped to a smelter by rail. The tailings will be deposited as a paste in an impoundment behind an embankment.

Mine water will be stored seasonally in underground workings; excess water will be discharged to the Clark Fork River after treatment. The water treatment system will include semi-passive biotreatment and a reverse osmosis system. At the end of operations, all remaining surface area disturbances and facilities will be reclaimed. Water treatment of mine water and tailings seepage will continue as long as necessary until each water source meets appropriate water quality standards or limits without treatment. The mine adits will either be a) plugged with concrete bulkheads and sealed once the mine water meets ground water or surface water standards, and the mine workings flooded with mine water, or b) sealed against unauthorized access and the mine water drained or pumped, after treatment, if necessary, to the Clark Fork River in perpetuity.

Development of the evaluation adit will take about a year. Work will start with 39 employees in the first quarter and increase to a maximum of 73 workers in the fourth quarter. Mine construction and production startup will take about 3.5 years. Contract construction will occur during the first 18 months of this phase. It will employ 235 workers initially, increasing to 345 during the fifth quarter. During this same period, employment will start at 34 employees and eventually reach 355 jobs as the mine approached full production. The combined total of contract and company employees will peak at 433 jobs during the fifth quarter before dropping to 92 employees in the seventh quarter.

Permanent operating employment is projected to stabilize at 355. The project will operate 24 hours per day, 7 days per week, and 354 days per year. At the end of production there will be a 2-year shutdown and reclamation period employing 35 workers.

Project mitigation will include the following grizzly bear mitigation measures:

- Secure or protect from development and use (timber harvest, grazing, mining) 2,350 acres of replacement habitat to compensate for acres lost by physical alterations, or acres with reduced habitat availability due to disturbance through conservation easement, including road closures, or acquisition. All replacement habitat (except for the ventilation adit) will be in place prior to the initiation of full operations. Replacement habitat for the ventilation adit will be in place prior to its construction, if the adit becomes necessary.
- Place a berm or barrier on NFS road #4784 within 1 year of issuing the permit for the evaluation adit to increase core area in BMU 5 for the life of the mine.
- Prior to construction, place a barrier on 1.6 miles of NFS road #2285, 0.81 miles of NFS road #2741X, and gate 0.5 mile of NFS road #2741A and 2.92 miles of NFS road #150 year-long.
- Fund two local FWP grizzly bear management specialist positions (with focus on public information and education) and a local FWP law enforcement position to aid in grizzly bear conservation for the life of the mine.
- Defer the construction phase of the mine until at least six female grizzly bears have been augmented into the Cabinet Mountains portion of the Recovery Zone (south of U.S. 2).

The Rock Creek Project is approved by the agencies but no reclamation bond has been posted. DEQ has not issued an operating permit and the KNF has not issued its authorization to implement the proposed Plan of Operations. The evaluation adit phase of the project has been approved but no reclamation bond has been posted.

#### 3.3.1.2 Libby Creek Ventures Drilling Plan

Libby Creek Ventures proposed the drilling of three borings adjacent to the Upper Libby Creek Road (NFS road #2316) on its two claims located in Section 15, Township 27 North, Range 31 West. A 20-ton rotary-hammer type truck-mounted drill rig with a trailer and two pick-up trucks will be used to drill the holes and the active drilling will take place during 3 days. Mobilization and equipment maintenance may increase the total active time to 1 week. The KNF's approved Plan of Operations expired on October 18, 2008 (USDA Forest Service 2007b). About 1 acre of surface disturbance will be associated with the drilling project.

### 3.3.2 KNF Management Activities

#### 3.3.2.1 Wayup Mine/Fourth of July Road Access

The KNF completed an EIS and issued a ROD for the Wayup Mine and Fourth of July Road Access. The proposed action will permit access across National Forest System lands to private property located in the upper West Fisher Creek drainage. The Wayup Mine is located in the headwaters of West Fisher Creek and the Fourth of July is located near Lower Geiger Lake (USDA Forest Service 2000a, 2000b). The Wayup Mine proposal will involve reconstruction, maintenance, spot reconstruction, and use of two existing roads. These roads will provide the proponent access across National Forest System lands to about 40 acres of private property known as the Wayup Mine. The first road is an existing non-system road and the second road is NFS road #6746. The Fourth of July proposal will involve reconstruction of 0.72 mile of road and

will begin at the end of NFS road #6748 at the Lake Creek trailhead and proceed southwest on the non-system Irish Boy Mine road to a proposed bridge site on Lake Creek. Reconstruction will consist of clearing trees, brush, and stumps from the existing road corridor. It will also include removing slumps, outsloping and installing surface drainage structures, and slash disposal. New construction of 1.8 miles of road would begin at the proposed bridge site and extend to the Fourth of July parcel. Construction would consist of clearing trees, brush, and stumps for a road corridor up to 60 feet wide on steep slopes, earthmoving to create a 12- to 16-foot surface, installation of road surface drainage structures and culverts, construction of one bridge, and slash disposal.

#### 3.3.2.2 Miller-West Fisher Vegetation Management Project

The KNF is preparing an EIS to disclose the environmental effects of vegetation management through commercial timber harvest, precommercial thinning, and prescribed fire; access management changes; trail construction and improvement; treatment of fuels in campgrounds; and watershed rehabilitation activities. The project area is 20 miles south of Libby, Montana in the Silverfish PSU on the Libby Ranger District of the KNF and contains Miller, West Fisher, and Silver Butte Creek watersheds. Alternative 4 of the Miller-West Fisher Vegetation Management Project EIS is the KNF's preferred alternative and is used in the cumulative effects analysis. The project will consist of:

- Vegetation treatments on 5,800 acres, including commercial timber harvest and associated fuel treatments, precommercial thinning, and prescribed burning without associated timber harvest.
- Road and access management, including access changes on 8.7 miles of road; 1.2 miles of new road construction, and 12.1 miles of road storage, and 0.87 mile of road decommissioning. Improvement, construction, and reconstruction of 5.5 miles of trail tread.
- Fuels and hazardous tree removal in Lake Creek Campground.
- Watershed condition improvement in the form of BMP implementation, including installation of ditch relief culverts, culvert replacement, surface water deflectors, and cleaning ditches is proposed for all haul routes. Additional BMP work on roads not used for timber haul is proposed and will be performed as funding becomes available. Stream stabilization projects are also proposed.
- Design features and mitigations to maintain and protect resource values.

### 3.3.3 Private Lands Activities

#### 3.3.3.1 Poker Hill Rock Quarry

Plum Creek has a permitted a quarry called the Poker Hill site located in W½NE¼, E½NW¼, Section 9, Township 28 North, Range 30 West. The quarry site will have a 16-acre permit area and disturb 3.1 acres for quarrying and 0.5 acre for a staging area. The quarry will produce decorative rock used for landscaping, retaining walls, and masonry. Riprap and gravel may be used for road BMP upgrades and maintenance. Rock tumblers, splitters, crushers, and blasting may be used on the quarry site to help create the desired products.

Reclamation will include recontouring slopes where needed, grass seeding, weed spraying, reshaping high walls and pit areas where possible as described in the general plan of operations.

All access roads, which are needed for future timber management, will be left unreclaimed and maintained up to forestry BMP standards. Access to the quarry will use existing Plum Creek roads.

#### 3.3.3.2 Kootenai Business Park U.S. 2 Entrance Relocation

The current entrance from U.S. 2 to the Kootenai Business Park is in close proximity to a residential area. To accommodate anticipated industrial use and avoid conflicts with residential use, the Libby Port Authority is proposing, in conjunction with the redevelopment of the Kootenai Business Park, to relocate the southern entrance to the Business Park about 400 feet to the south on U.S. 2. The access road from U.S. 2 would be designed and constructed to MDT standards. Construction of the new access road entrance is anticipated to begin in summer of 2009. MMC would use this access to the Libby Loadout.

#### 3.3.3.3 Other Actions on Private Lands

Continued development of private lands within the analysis area is expected. Development is expected to include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stabilization of stream banks.

## 3.4 Air Quality

### 3.4.1 Regulatory Framework

Under the federal Clean Air Act (amended 1990), EPA sets National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. EPA has set NAAQS for six principal pollutants: carbon monoxide (CO); lead; nitrogen oxides ($NO_x$); particulate matter with an aerodynamic diameter less than 10 and 2.5 microns ($PM_{10}$ and $PM_{2.5}$); ozone; and sulfur oxides ($SO_2$). These pollutants are referred to as criteria pollutants. The Clean Air Act established two types of standards for criteria pollutants. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (EPA 2006a). Under Montana's implementation of the Clean Air Act, Montana has established Montana Ambient Air Quality Standards (MAAQS) for criteria and other pollutants. NAAQS and MAAQS are presented in Table 46.

An area is designated as attainment when existing concentrations of all regulated pollutants are below the NAAQS and MAAQS. Likewise, an area is designated as non-attainment when existing concentrations of one or more regulated pollutants are above the NAAQS and MAAQS. The Montanore Project production and processing facilities would be located in an area designated as "attainment" for all regulated pollutants.

The city of Libby and surrounding area has been designated a non-attainment area for both $PM_{2.5}$ and $PM_{10}$. The closest boundary of the $PM_{10}$ non-attainment area is 8.9 miles north of the proposed Little Cherry Creek Tailings Impoundment. The closest boundary of the $PM_{2.5}$ non-attainment area is 1.5 miles north of the tailings impoundment. The Libby Loadout would be located within the Libby $PM_{10}$ and $PM_{2.5}$ non-attainment area.

The Montanore Project would be required to obtain a Montana Air Quality Permit (MAQP) because the facility has the potential to emit more than 25 tons per year (tpy) of one or more criteria air pollutants. The mine and mill (plant) facility would be considered a minor source under the Title V and Prevention of Significant Deterioration (PSD) regulations because total potential emissions from point sources underground and on the surface would be less than 250 tpy for any criteria pollutants. The Montanore Project would not meet the definition of a major source. The Project would be considered a minor source and would not require a Title V operating permit under ARM 17.8.1204 because the potential emissions are less than 100 tpy for any pollutant, less than 10 tpy for any single hazardous air pollutant (HAP), and less than 25 tpy for total HAPs (TRC Environmental Corp. 2006a).

MMC submitted an application for a MAQP in January 2006 (TRC Environmental Corp. 2006a). The application was revised and resubmitted in May 2006 to incorporate additional information and analyses requested by the DEQ ARMB, and the application was deemed complete in July 2006.

The PSD program is implemented primarily through the use of pollutant increments and area classifications. An increment is the maximum increase (above a baseline concentration) in the ambient concentration of $PM_{10}$, $SO_2$ and $NO_x$ that would be allowed in an area. The area classification scheme establishes three classes of geographic areas and applies more stringent

increments to those areas recognized as having higher air quality values. Class I areas are accorded the highest level of protection by allowing the smallest incremental pollutant increase. Project facilities would be located in an area designated as Class II under PSD regulations and the CMW is designated as Class I.

The Montanore Project would be a minor source under PSD regulations and, as such, analysis of visibility impacts is not explicitly required (TRC Environmental Corp. 2006b). At the request of the DEQ Air Resources Management Bureau (ARMB), potential plume impairment was evaluated generally following guidance established by the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) in its 2000 Report (FLAG 2000). The FLAG document describes three levels of analysis for plume impairment assessments. Levels one and two are screening level analyses that use the VISCREEN model for assessing plume impairment impacts, and level three is a refined analysis using the PLUVUE II model. (Citation for all models mentioned in this section is available from the Montana ARMB). If a screening analysis demonstrates that visibility impacts from plume impairment are below threshold values, then no further analysis is required.

The PLUVUE II model estimates plume perceptibility in terms of change in color difference ($\Delta E$) and contrast ($|C|$). The Levels of Concern (LOC) or threshold values for plume perceptibility provided in the FLAG document are contrast ($|C| = 0.02$) and change in color difference ($\Delta E = 1.0$).

The Forest Service provides guidance to evaluate the potential impact of sulfur (S) and nitrogen (N) deposition, calculated from sources of $SO_2$ and $NO_x$ operating during Montanore Mine production. The Forest Service Level of Acceptable Change (LAC) thresholds for lakes with different acid-neutralizing capability (ANC) are (USDA Forest Service 2000c):

| | |
|---|---|
| 10%: | Lakes with ANC > 25 microequivalents/liter (μeq/l) |
| 1 μeq/l: | Lakes with ANC ≤ 25 μeq/l |

## 3.4.2 Analysis Area and Methods

### 3.4.2.1 Analysis Area

The analysis area is an area around project facilities where air emissions would occur. The facilities are the Ramsey and Libby Plant sites, the Ramsey and Libby Adit sites, the Little Cherry Creek and Poorman tailings impoundment areas, LAD Areas, all access roads, alternate transmission line alignments, Sedlak Park Substation, and the Libby Loadout. The Libby Loadout is included in the analysis area because the loadout would be covered by the DEQ Operating Permit.

### 3.4.2.2 Methods

#### *3.4.2.2.1 Baseline Data Collection*

Meteorological conditions and air quality parameters were monitored between July 1, 1988 and June 30, 1989 at two sites—the Ramsey Creek Air Monitoring Site in the upper Ramsey Creek drainage at the Ramsey Plant Site and the Little Cherry Creek Air Monitoring Site south of the Little Cherry Creek Tailings Impoundment (meteorological data only) (Woodward-Clyde Consultants 1989b). The monitoring locations are shown on Figure 2.3 in the MAQP Application

(TRC Environmental Corp. 2006a). The monitoring results were used in the air quality and visibility analyses for both the 1992 EIS (USDA Forest Service *et al.* 1992) and this EIS. Only data from the Ramsey Creek Air Monitoring Site were used because the data recovery at the Little Cherry Creek Air Monitoring Site was not as complete and because Ramsey Creek Air Monitoring Site meteorological data are more representative of the conditions where a majority of pollutant emissions would be emitted (the Ramsey and Libby adits). The Ramsey Creek Air Monitoring Site meteorological data were combined with twice-daily upper air mixing height data from Spokane, Washington, the closest upper air meteorological site to the mine area (TRC Environmental Corp. 2006a). The baseline meteorological and air quality measurements made during the 1988-1989 baseline year are considered to be representative of 1 year at this site, with the exception of precipitation, which was much lower than normal during this period (section 3.4.3, *Affected Environment*).

Maximum hourly and/or daily and annual average emission rates of $PM_{10}$, $PM_{2.5}$, total suspended particulates (TSP), $NO_x$, CO, $SO_2$, and trace metals including antimony, arsenic, cadmium, chromium, and lead were calculated for all sources and regulated pollutants. Copper and silver were not included because they are not regulated in air. This differentiation between short-term (hourly and daily) and long-term averages applies most specifically to emission sources for which annual operating limits are proposed, but have the potential to operate at maximum load on an hourly and/or 24-hour basis. For modeling purposes, it was assumed mine construction would commence and the mine would phase in production, reaching full production in operating Year 4. Operations for Year 4, the first year of maximum production, were considered the worst-case production emissions scenario and were used for emission calculations (TRC Environmental Corp. 2006a).

Ambient air quality background concentrations were established using monitoring and other available data. Background concentrations were added to modeled concentrations predicted to be emitted from the Montanore Mine to obtain total concentrations for comparison to NAAQS and MAAQS. Annual $NO_x$ concentrations were adjusted using the Ambient Ratio Method. Hourly $NO_x$ concentrations were adjusted using the Ozone Limiting Method (OLM) as described in the Draft Montana Modeling Guideline for Air Quality Permit Applications (DEQ 2007). The ozone ambient standard of 196 micrograms per cubic meter ($\mu g/m^3$) was assumed to be ambient background for the OLM calculation (TRC Environmental Corp. 2006a).

##### *3.4.2.2.2 Impact Analysis*

MMC's air permit application included an air dispersion modeling analysis updated from the 1992 EIS analysis, which was conducted to demonstrate compliance with ambient air quality standards following guidance in the Draft Montana Modeling Guideline for Air Quality Permits (DEQ 2007) and in accordance with EPA guidance. The analysis quantified $PM_{10}$, $PM_{2.5}$, $NO_x$, $SO_2$, and lead emissions and their impacts.

Although not required by current regulations and permit requirements, the DEQ requested that MMC conduct additional modeling, including:

- An analysis of impacts to air quality related values (AQRV) in the CMW Class I Area
- Assessment of impacts to Libby $PM_{10}$ and $PM_{2.5}$ non-attainment areas
- Determination of potential effects of terrain-induced downdraft (a sudden drop in terrain causing turbulence on the downwind side which results in mixing and dispersion of air pollutants)

- Potential impacts to ambient air quality from construction activities (TRC Environmental Corp. 2006a)

A visibility impact assessment, acid deposition impact assessment, and comparison of modeled concentrations to PSD Class I Increments are not explicitly required for minor source MAQP applications. Due to the close proximity (0.25 mile) of the mine to the CMW, a PSD Class I Area, the DEQ requested that these analyses be completed (TRC Environmental Corp. 2006a). The DEQ also requested that an analysis be performed to predict ambient $PM_{10}$ and $PM_{2.5}$ contributions from the Montanore Mine to air quality in the Libby non-attainment areas, including the assessment of sulfate and nitrate contribution to total $PM_{2.5}$ impacts (TRC Environmental Corp. 2006a). MMC also submitted new modeling of the impacts from trace metals released during ore, tailings, and concentration mining handling and processing. Montana does not have air toxics impact regulations and MMC is not explicitly required to assess human health risks from metals emissions. MMC provided a screening-type human health risk assessment for trace metals classified as HAPs to provide a full disclosure of potential HAP impacts (DEQ 2006).

None of the modeling completed for the 1992 EIS were used in this Draft EIS. All modeling and analyses are new. Up-to-date models were used and the new data generated by the modeling have been analyzed in this EIS.

Several years ago, the AERMIC (American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee) was formed to introduce state-of-the-art modeling concepts into the EPA's local-scale air quality models. The AERMIC focused on a new platform for regulatory steady-state plume modeling. EPA adopted the recommended new program, AERMOD, in 2005 as the recommended refined model to be applied in areas of simple and complex terrain. The DEQ adopted the EPA recommendation and mandated use of AERMOD in place of Industrial Source Complex (ISC) models. In 2007, MMC completed additional modeling with the following changes:

- The AERMOD modeling system was used to remodel the ambient air quality impact for Alternative 2
- Two options for ventilation were analyzed as for Alternatives 3 and 4 (using AERMOD)

For Alternative 2, all sources remained at the same emission rates and stack parameters as modeled with ISCST3 (ISC Short Term) model, except the Libby Adit portal that was broken into two identically sized sources at the same location. This was done because the algorithms used in the AERMOD model could not process a single source with such a large exit diameter and therefore very small exit velocity. This artificial splitting into two pieces of the Libby Adit portal source to accommodate the AERMOD model requirements is equivalent to the way the source was modeled (as a single source) earlier using ISCST3 (Sage Environmental Consulting 2007).

For Alternatives 3 and 4, the Libby Plant Site would be northeast of the Libby Adit Site, and two adits would be constructed at the Libby Adit Site and one adit at the Upper Libby Adit Site. For the AERMOD modeling of these alternatives, the four plant area emission sources and the emergency generator source were located at the Libby Plant Site. Two ventilation scenarios were modeled for the adits. One modeled scenario assumed all underground emissions exited through

one of the two Libby Adits. In this scenario, the Upper Libby Adit would be used for intake. Libby Adit dimensions were assumed to be the same in all alternatives. All other mine emissions sources were modeled as they were for Alternative 2 (Sage Environmental Consulting 2007).

In another modeled scenario, the assumptions were the same as the first scenario except underground emissions would be split between one of the two Libby Adits and the Upper Libby Upper Adit. The other Libby Adit would be used for intake (Sage Environmental Consulting 2007).

## 3.4.3 Affected Environment

### 3.4.3.1 Climate

#### *3.4.3.1.1 Regional Climate*

The region has a "modified continental maritime" type of climate. The regional climate is influenced and modified by Pacific Ocean maritime air masses. Summers are warm and dry, and winters are cold. The Pacific Ocean influences development of coastal storms, which occasionally track across the State of Washington, and east into northern Idaho and Montana. The relatively high mountain ranges to the west and north tend to reduce the effects of these storms, so that more rain or snow occurs on the west or north side of the Cabinet Mountains than the south or east sides. In winter, cold Canadian air masses can cause periods of extremely cold temperatures. Cold air movement into the region forms temperature conditions that may trap pollutants near the land surface. More frequently, dry continental air masses from Canada or the east influence the region. In summer, these air masses create conditions of warm temperatures and low humidity.

#### *3.4.3.1.2 Analysis Area Climate*

Although similar to the regional climate, the climate of the analysis area is highly influenced by local terrain and elevation. The analysis area's mountainous terrain produces significant precipitation and temperature variations. Analysis area elevations range from 2,600 feet along U.S. 2 to almost 8,000 feet at Elephant Peak in the Cabinet Mountains. Elevation in the City of Libby is 2,062 feet. The terrain in the immediate vicinity of the proposed facilities is mountainous with large changes in elevation over short distances (MMI 2005a).

Wind velocities vary according to terrain features, with higher wind speeds at ridge tops and lower wind speeds in protected valleys. The upper level winds above 10,000 feet come predominantly from the northwest, and surface winds follow topographic relief (valley flow) in times of stable weather activity. Based on wind data collected in 1988-1989, over 50 percent of the winds at the Ramsey Creek Air Monitoring Site and nearly 90 percent of the winds at the Little Cherry Creek Air Monitoring Site were less than 3.5 miles per hour (mph). The average wind speed at Ramsey Creek was 5 mph. The highest wind speed recorded was 28.4 mph at the Ramsey Creek Air Monitoring Site. Wind speed averaged 2.4 mph at the Little Cherry Creek Air Monitoring Site (Woodward-Clyde Consultants 1989b).

Predominant wind directions are from the southwest-to-southeast sectors (Woodward-Clyde Consultants, Inc. 1989b). The measured predominant wind direction at the Ramsey Creek Air Monitoring Site is south-southeast. Maximum wind speeds are also associated with south-southeast winds. This is in contrast to the tendency for upper level winds to be from the northwest. The predominant wind direction is also inconsistent with the orientation of the creek drainage (southwest-to-northeast), although winds from the southwest and south-southwest were

measured about 30 percent of the time. Maximum wind speeds at the Ramsey Creek Air Monitoring Site were associated with south-southeast winds, and with south-southwest winds at the Little Cherry Creek Air Monitoring Site. Valleys in western Montana have a strong potential for the formation of temperature inversions (stable atmospheric conditions with little air mixing).

Precipitation data for the project area are available from a monitoring site in upper Poorman Creek, about 1 mile north of the proposed Ramsey Plant Site. Based on data from 1969 to 1987, the average annual precipitation is 32 inches in the proposed tailings impoundment area (elevation 3,400 to 3,700 feet), with 50 to 60 inches at the Libby Adit and Ramsey Plant sites (elevation 4,000 to 4,500 feet) (Geomatrix 2007a). More recent data (1999 to 2004) show about 10 percent greater precipitation than the 1969 to 1987 data. Precipitation increases with increasing elevation. About 35 percent of precipitation is snow that generally falls between October and May. Rain-on-snow also may occur in mid-winter and early spring, which can result in significant runoff events (Geomatrix 2007a). Temperatures in the analysis area are cold in the winter and mild in the summer. The annual average temperature is about 41°F with a range between -26°F and 95°F (hourly average).

### 3.4.3.2 Particulate Matter and Gaseous Pollutants

#### *3.4.3.2.1 Airborne Particulate Matter*

Concentrations of TSP and $PM_{10}$ are typical of remote, mountainous sites. At the Ramsey Creek Air Monitoring Site, the annual average $PM_{10}$ was 14 $\mu g/m^3$ and the maximum 24-hour concentration was 35 $\mu g/m^3$ (Table 44). $PM_{10}$ concentrations are in compliance with the MAAQS and NAAQS. MAAQS and NAAQS for TSP have been rescinded since the time the data were collected. The maximum measured $PM_{10}$ and TSP values each exceeded their respective standards on one occasion in the fall of 1988, likely due to the numerous forest fires in the region, and do not represent normal background conditions. At the Little Cherry Monitoring Site, the arithmetic mean $PM_{10}$ concentration was 14 $\mu g/m^3$ and the geometric mean for the TSP sampler was 33 $\mu g/m^3$ (Woodward-Clyde Consultants Inc. 1989a).

Table 44 also lists background concentration values for $PM_{2.5}$, $NO_x$, $SO_2$, CO, and lead. The $PM_{2.5}$ background values were obtained from the Forest Service IMPROVE site, about 3 miles south of the CMW southern boundary. The $NO_x$, $SO_2$, and CO values are typical values provided by DEQ for use in permit modeling analyses. The TSP filters at the Little Cherry Creek Air Monitoring Site were chemically analyzed for trace metals including lead.

Trace metal concentrations measured in the total suspended particulate matter samples were low. None of the monthly values exceed any federal ambient standard or Montana guideline concentration (TRC Environmental Corp. 2006a).

Libby was designated as a non-attainment area for $PM_{10}$ as part of the 1990 Clean Air Act amendments. Airborne particulate levels in Libby and nearby residential areas were above the $PM_{10}$ standard in the 1980s and early 1990s, but are currently lower due to air quality control measures. The last violation of the $PM_{10}$ 24-hour standard was in 1990. The DEQ continues to operate a $PM_{10}$ monitoring site at the Lincoln County Courthouse Annex roof near the center of Libby. In 2005, EPA designated Lincoln County as a non-attainment area for $PM_{2.5}$ based on measured concentrations exceeding the NAAQS for $PM_{2.5}$ set forth in the Clean Air Act.

**Table 44. Background Concentrations Used in the Air Quality Modeling.**

| Pollutant | Averaging Period | | | |
|---|---|---|---|---|
| | Annual | 24-Hour | 3-Hour | 1-Hour |
| $PM_{10}$ | 14 | 35 | NA | NA |
| $PM_{2.5}$ | 3.5 | 10.4 | NA | NA |
| $NO_x$ | 6 | NA | NA | 75 |
| $SO_2$ | 3 | 11 | 26 | 35 |
| CO | NA | 1,150 | NA | 1,725 |
| Lead | 0.006 | NA | NA | NA |

All concentrations are in micrograms per cubic meter ($\mu g/m^3$)
NA = Not applicable
Source: TRC Environmental Corp. 2006a.

##### *3.4.3.2.2 Gaseous Pollutants*

No measurements of other criteria pollutants and their precursors, such as CO, $SO_2$, ozone, $NO_x$, or hydrocarbons, were made in the analysis area. Given the remoteness of the analysis area and the lack of air pollution sources and minimal human impact, low background concentrations are expected (Table 44).

#### 3.4.3.3 Visibility

Visibility is usually high, except during times of forest fires or controlled burning. The nearby CMW is classified as a Class I PSD area. This designation is for those areas of the country (such as National Parks and wilderness areas) where little or no air quality degradation is allowed. In addition to strict ambient air quality standards, visibility protection is also required.

#### 3.4.3.4 Acid-neutralizing Capability of Mine Area Lakes

There are two types of acidification that affect lakes and streams. One is a year-round condition when a lake is acidic all year long, referred to as chronically or critically acidic. The other is seasonal or episodic acidification associated with spring melt and/or rain storm events. A lake is considered insensitive when it is not acidified during any time of the year. Lakes with acid-neutralizing capability (ANC) values below 0 µeq/l are considered to be chronically acidic. Lakes with ANC values between 0 and 50 µeq/l are considered susceptible to episodic acidification. In the analysis area, Libby Lakes are the most susceptible to acidification. Upper Libby Lake had an average ANC value of 4.5 µeq/l between 1991 and 2006; Lower Libby Lake's ANC averaged 14.4 µeq/l over the same period. Upper Libby and Lower Libby Lakes have variable but generally declining ANC and stable pH (USDA Forest Service 2008b). The declining trend in ANC in the Libby Lakes is not readily explainable, because no similar trend occurred in the comparable Selway Bitterroot Wilderness, according to the Forest Service's recent analysis of data collected from 1993 through 2007 (USDA Forest Service 2008b). Rock Lake's ANC ranged from 44 to 60 µeq/l in one sample event each in 1991, 1992, (USDA Forest Service 2008b) and 1999 (Gurrieri and Furniss 2004). St. Paul Lake's ANC was 168 µeq/l when measured in 1991 (USDA Forest Service 2008c).

Sulfate ($SO_4$) and nitrate ($NO_3$) are acidifying anions. Because alpine lakes are sensitive to pH change, sulfate and nitrate levels are monitored for annual variations. Despite overall trends in the

west of decreasing $SO_4$, the lakes did not show a decreasing $SO_4$ trend. This may be due to weatherization of bedrock surrounding the lakes or the lakes may be too far from sulfates source to be significantly affected by emission decreases. No strong trends in $NO_3$ and $NH_4$ are discernible. Overall $NH_4$ levels appear to be increasing slightly in the CMW. The $NO_3$ appears to be fairly stable or decreasing. A decrease trend in nitrate does not fit with the overall increasing trend throughout the west. The low nitrate concentrations, which include non-detectable for most sampling events, are likely due to quick assimilation by precipitation and watershed source nitrate by phytoplankton except for Upper Libby Lake, which is very oligotrophic and has limited algae, which evidently reduces nitrate assimilation rates (USDA Forest Service 2008b).

## 3.4.4 Environmental Consequences

### 3.4.4.1 Alternative 1 – No Mine

The increased air emissions from mine construction and operation described under the mine alternatives would not occur. The ambient air quality and visibility in the CMW would not be affected by the proposed mine. Existing trends in air quality of the analysis area would continue. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

### 3.4.4.2 Alternative 2 – MMC's Proposed Mine

#### *3.4.4.2.1 Particulate Matter and Gaseous Pollutants*

Pollutants emitted by the proposed project would be from fugitive sources such as haul roads, from mobile sources such as earth moving equipment, and from point sources such as generators. $PM_{10}$ and $NO_x$ would be the primary pollutants (Table 45).

**Table 45. Total Air Emissions for Alternative 2.**

| Pollutant | Point Source Emissions (tpy) | Fugitive Emissions (tpy) | Mobile Source Emissions (tpy) |
|---|---|---|---|
| $PM_{10}$ | 12.7 | 138 | 5.07 |
| $PM_{2.5}$ | 2.62 | 20.6 | 5.07 |
| $NO_x$ | 3.60 | 1.33 | 163 |
| $SO_2$ | 0.01 | 0.14 | 6.32 |
| CO | 0.47 | 64.7 | 56.6 |
| Volatile organic compounds | 0.13 | 0.00 | 9.01 |
| Lead | 0.0007 | 0.0014 | <0.0001 |

tpy = tons per year.
Source: DEQ 2006.

Dispersion model results were compared to applicable ambient standards. Ambient background concentrations were added to modeled concentrations to obtain total concentrations for comparison to the NAAQS and MAAQS. Model results for all analyzed pollutants would comply with all NAAQS and MAAQS (Table 46).

**Table 46. Maximum Concentrations During Operations in Alternative 2 Modeled with ISCST3 Compared to MAAQS and NAAQS.**

| Pollutant | Averaging Period | Maximum Modeled Concentration ($\mu g/m^3$) | Pollutant Background ($\mu g/m^3$) | Total Concentration (Modeled + Background) ($\mu g/m^3$) | MAAQS ($\mu g/m^3$) | % of MAAQS | NAAQS ($\mu g/m^3$) | % of NAAQS |
|---|---|---|---|---|---|---|---|---|
| $PM_{10}$ | Annual | 4.09 | 14 | 18.09 | 50 | 36.2 | Revoked | — |
| | 24-Hour† | 21.66 | 35 | 56.66 | 150 | 37.8 | 150 | 37.8 |
| $PM_{2.5}$ | Annual | 2.1 | 3.5 | 5.60 | — | — | 15 | 37.3 |
| | 24-Hour† | 13.97 | 10.4 | 24.37 | — | — | 35 | 69.6 |
| $NO_x$ | Annual§§ | 19.8 | 6 | 25.8 | 94 | 27.5 | 100 | 25.8 |
| | 1-Hour§ | 364 | 75 | 439 | 564 | 77.8 | — | — |
| $SO_2$ | Annual | 1.92 | 3 | 4.92 | 52 | 9.5 | 80 | 6.2 |
| | 24-Hour† | 12.25 | 11 | 23.25 | 262 | 8.9 | 365 | 6.4 |
| | 3-Hour† | 42.15 | 26 | 68.15 | — | — | — | — |
| | 1-Hour† | 51.42 | 35 | 86.42 | 1,300 | 6.7 | — | — |
| Lead | Quarterly* | 0.00026 | NA | 0.00026 | — | — | 1.5 | 0.02 |
| | 90-day* | 0.00026 | NA | 0.00026 | 1.5 | 0.02 | — | — |

†Concentrations are high second-high values. Certain ambient air quality standards are "not to be exceeded more than once per year." DEQ looks at the highest second high value for maximum modeled concentrations.
§The ozone limiting method has been applied to this result.
§§The ambient ratio method has been applied to this result.
*The 1-month average concentration is used for compliance demonstration.
NA = Not available.
$\mu g/m^3$ = microgram per cubic meter.
Source: DEQ 2006.

The Libby Loadout would be completely enclosed; no particulate emissions would occur from transfer, storage, or loading activities at the site (Figure 12). The transfer and loading of concentrate onto rail cars would be conducted within the pressurized load-out building. The concentrate would possess a high moisture content (16 percent to 20 percent), which would inherently control particulate emissions. Any product loss from trucks outside the load-out facility would be swept promptly. The complete enclosure of the handling and transfer operations within the pressurized building, combined with the other product loss control methods, is estimated to control emissions from the transfer and loading operations.

#### *3.4.4.2.2 Application Scenario ISCST3 to AERMOD Results Comparison*

Maximum modeled concentration impacts with the AERMOD model were less than previous ISCST3 results for all modeled pollutants and averaging periods. AERMOD-modeled impacts ranged from about 62 percent to 90 percent of the ISCST3 predicted concentrations when representative background values are included in the total concentrations (Table 47). All maximum modeled concentrations (with background) were below applicable NAAQS and MAAQS (Sage Environmental Consulting 2007).

For the receptors placed in the nearby CMW, AERMOD predicted concentrations for all pollutants and averaging periods that were below those predicted by ISCST3, with AERMOD-predicted values ranging from about 19 percent to 26 percent of those values predicted with ISCST3. All modeled concentrations were below applicable PSD Class I increments (Sage Environmental Consulting 2007). Implementation of Alternative 2 would not result in incremental concentration increases greater than PSD Class I increments within the CMW.

**Table 47. ISCST3 and AERMOD Modeled Concentrations Plus Background Concentration for Alternative 2.**

| Pollutant | Averaging Period | Class II | | Class I | | Class I Increment |
|---|---|---|---|---|---|---|
| | | 3ISCST3 | AERMOD | ISCST3 | AERMOD | |
| | | (μg/m$^3$) | (μg/m$^3$) | (μg/m$^3$) | (μg/m$^3$) | (μg/m$^3$) |
| $PM_{10}$ | Annual | 18.09 | 16.45 | 0.25 | 0.05 | 4.00 |
| | 24-Hour† | 56.66 | 50.96 | 4.18 | 1.08 | 8.00 |
| $PM_{2.5}$ | Annual | 5.60 | 4.72 | — | — | — |
| | 24-Hour† | 24.37 | 18.17 | — | — | — |
| $NO_x$ | Annual | 25.84 | 17.41 | 1.62 | 0.30 | 2.50 |
| | 1-Hour† | 438.94 | 309.08 | — | — | — |
| $SO_2$ | Annual | 4.92 | 4.18 | 0.10 | 0.02 | 2.00 |
| | 24-Hour† | 23.25 | 18.52 | 2.24 | 0.55 | 5.00 |
| | 3-Hour† | 68.15 | 42.27 | 7.97 | 1.83 | 25.00 |
| | 1-Hour† | 86.42 | 56.35 | — | — | — |

†High 2nd high values.
μg/m$^3$ = microgram per cubic meter.
Source: Sage Environmental Consulting 2007.

#### *3.4.4.2.3 Hazardous Air Pollutant Impact Assessment*

Various metals would be present in ore, tailings, waste rock, concentrate, and road dust. Some of the metals are considered HAPs. Modeled concentrations of arsenic, cadmium, and chromium in

emissions were predicted to be above the DEQ's incinerator risk assessment levels, and these compounds were carried forward in the analysis. The Montanore Project proposed life is 16 years. The total combined cancer risk from these three metals was determined by summing the cancer risk of each metal using a 20-year exposure period and was found to be 1 in 1,000,000.

Potential air emissions of lead were modeled for the mine and reported in the air permit application (TRC Environmental Corp. 2006a). Emissions of lead, both a criteria pollutant and a HAP, were calculated based on preliminary ore assays conducted by Noranda (TRC Environmental Corp. 1989). Lead assays performed on the main ore body and on concentrate produced a mass fraction of lead in the analyzed material: 0.005 percent lead in ore and 0.44 percent lead in concentrate. Lead emissions are calculated as particulate emissions multiplied by the appropriate lead mass fraction. Predicted lead concentrations are below the NAAQS and MAAQS (Table 46) (TRC Environmental Corp. 2006a).

No relevant Montana risk assessment guidance exists; as a result, carcinogenic risk was calculated based on currently established unit risk factors for lifetime exposure as defined in the Integrated Risk Information System (IRIS) database (IRIS 2005). Predicted lead concentrations are well below the quarterly MAAQS; the maximum modeled concentration for lead is 0.00026 $mg/m^3$ at the north side of the Ramsey Plant Site boundary (receptor location) compared to 1.5 $mg/m^3$ MAAQS and NAAQS (or 0.2 percent of the standard). There is no IRIS Lifetime Cancer Risk Factor currently available for lead.

#### *3.4.4.2.4 Construction Emissions*

Construction activities would be temporary and would precede full production, which for modeling purposes, was assumed to be in Year 4. During the first phase of construction, underground construction activities would begin, no major surface construction activities would occur, and one 1,622 horsepower diesel electric generator (with one identical co-located unit on standby) would operate continuously at the Libby Adit to provide electrical power. The generator would operate until line power becomes available, which MMC expected to be less than 1 year from commencement of construction activities. After the Bear Creek Road underground electric line was installed, the generator would operate as an emergency backup only.

Dispersion modeling was performed for the first phase of construction, the only portion of construction during which a generator would operate continuously, to determine whether that construction activities would comply with ambient air quality standards. The maximum-modeled 1-hour $NO_x$ concentration was 364 $\mu g/m^3$ and the maximum annual average $NO_x$ concentration was 19.8 $\mu g/m^3$. Both concentrations are less than the MAAQS of 564 and 94 $\mu g/m^3$, respectively; there is no NAAQS for $NO_x$ (TRC Environmental Corp. 2006a).

#### *3.4.4.2.5 Non-attainment Area Boundary Impact Assessment*

The concentrate loadout facility in Libby would emit no pollutants to the atmosphere because the surface moisture of the concentrate and all loading activities would be enclosed by a building (TRC Environmental Corp. 2006a). Covered trucks would transport the concentrate to the Libby Loadout, and then back on to a concrete covered pad and dump concentrate into the concentrate building. Control devices would be used to control fugitive dust associated with concentrate handling and loading. The rail car would be located inside an enclosed area as another means to control fugitive dust. The openings of the rail car loadout building would be covered with heavy plastic strips or other similar devices to effectively act as a door.

Modeled concentrations of $PM_{10}$ and $PM_{2.5}$ from mine operations were calculated at receptors placed at regular intervals along each non-attainment area boundary, and were compared to EPA's proposed PSD Class II significance levels for $PM_{10}$. Significant impact levels have not been established by EPA for $PM_{2.5}$ non-attainment areas. Modeled concentrations were predicted to be less than $PM_{10}$ significance levels, indicating that mine operations would not significantly affect $PM_{10}$ concentrations within Libby's non-attainment areas (Table 48).

**Table 48. Comparison of Non-attainment Area Modeled Concentrations under Alternative 2 to PSD Class II Significance Levels.**

| Non-attainment Area | Pollutant and Averaging Period | Maximum Modeled Concentration ($\mu g/m^3$) | PSD Class II Significance Level ($\mu g/m^3$) |
|---|---|---|---|
| Libby, MT $PM_{10}$ | $PM_{10}$ Annual<br>$PM_{10}$ 24-Hour | 0.042<br>0.83 | 1.0<br>5.0 |
| Libby, MT $PM_{2.5}$ | $PM_{2.5}$ Annual<br>$PM_{2.5}$ 24-Hour | 0.44<br>1.75 | Not established |

$\mu g/m^3$ = microgram per cubic meter.
Source: DEQ 2006.

#### *3.4.4.2.6 Cabinet Mountain Wilderness Impact Assessment*

An analysis of air quality impacts at and within the PSD Class I Area boundary was completed, and concentrations were compared to PSD Class I Increments that exist for $PM_{10}$, $NO_x$, and $SO_2$. Modeled concentrations were predicted to be less than PSD Class I Increments at all locations at and within the Class I Area boundary (Table 49).

**Table 49. Modeled Concentrations in the CMW Compared to PSD Class I Increments.**

| Pollutant | Averaging Period | Maximum Modeled Concentration ($\mu g/m^3$) | PSD Class I Area Increment ($\mu g/m^3$) | % of PSD Class I Area Increment |
|---|---|---|---|---|
| $PM_{10}$ | Annual | 0.25 | 4 | 6.4 |
| | 24-Hour | 4.18 | 8 | 52.2 |
| $NO_x$ | Annual | 1.62 | 2.5 | 64.7 |
| $SO_2$ | Annual | 0.10 | 2 | 5.1 |
| | 24-Hour | 2.24 | 5 | 44.7 |
| | 3-Hour | 7.97 | 25 | 31.9 |

$\mu g/m^3$ = microgram per cubic meter.
Source: TRC Environmental Corp. 2006a.

The Air Quality Related Values analysis included dispersion modeling to determine visibility impacts, and nitrogen and sulfur deposition impacts on CMW from mine operations (TRC Environmental Corp. 2006b).

### Visibility Impact

Out of 1 year of hourly analyses, only 3 hours of potential plume impairment were found for each of the Ramsey Plant Site portal and the emergency generator at the Libby Adit. The emergency generator was modeled at maximum hourly emission rates year-round, although it is expected to be permitted to operate a maximum of 16 hours per year. The potential plume impairment hours would be just over the thresholds for color difference.

Contrast parameters were computed to be less than criteria set by EPA, indicating that there would be no perceptible contrast change or general haze in the CMW due to the mine. The reduction in visual range also was predicted to be below perceptible levels. Infrequent, episodic events, such as high winds causing erosion of the tailings impoundment surface could cause minor, short-term visual impacts from dust plumes that could be visible from the CMW and other areas.

### Nitrogen and Sulfur Deposition

Maximum nitrogen deposition impacts from the mine were found to be greater than the USDI National Park Service deposition analysis threshold (DAT); maximum sulfur deposition impacts were found to be comparable to the DAT. All impacts were below the Forest Service levels of concern (TRC Environmental Corp. 2006b).

The computer model predicted annual deposition fluxes of sulfur and nitrogen at sensitive water bodies in the CMW. These were used to estimate the change in ANC of at each location. The predicted change in ANC for sulfur and nitrogen was compared with the Forest Service Level of Acceptable Change (LAC) thresholds of 10 percent for lakes with background ANC values greater than 25 μeq/l, and 1 μeq/l for lakes with background ANC values of 25 μeq/l or less. The predicted change in ANC was below applicable LAC thresholds at all lakes analyzed (Table 50) (TRC Environmental Corp. 2006b).

**Table 50. Predicted ANC Change at Class I Sensitive Water Bodies.**

| Site | Background ANC (μeq/l) | Predicted Change in ANC (%) | Predicted Change in ANC (μeq/l) | LAC Threshold for ANC |
|---|---|---|---|---|
| Lower Libby Lake | 12.6 | NA | 0.80 | 1 μeq/l |
| Upper Libby Lake | 2.0 | NA | 0.87 | 1 μeq/l |
| Rock Creek | 59.5 | 0.986 | NA | 10% |

NA = Not applicable.
μeq/l = microequivalents/liter.
Source: TRC Environmental Corp. 2006b.

In summary, contrast parameters were computed to be less than criteria set by FLAG, indicating that there would be no perceptible contrast change or general haze in the CMW due to the project. The reduction in visual range also was predicted to be below perceptible levels. The predicted change in acid-neutralizing capability at sensitive lakes within the CMW is within the Forest Service LAC thresholds.

#### *3.4.4.2.7 Best Available Control Technology Analysis*

Emission controls to be used at the proposed project would constitute Best Available Control Technology (BACT), as required by ARM 17.8.752(1)(a). MMC would operate all equipment to provide for maximum air pollution control for which it was designed (TRC Environmental Corp. 2006a). Dust emissions from ore handling activities would be controlled with water sprays, wet Venturi scrubbers, baghouses, and enclosures. Ore grinding operations at the semi-autogenous grinding (SAG) mill would be fully enclosed and wet, with water pumped into the SAG mill at a rate of 7,780 gpm; therefore, the mill would not be a source of air emissions. Water sprays would be used, as needed, to prevent excess fugitive dust at the Little Cherry Creek Tailings Impoundment. Other proposed controls would be in compliance with BACT (DEQ 2006).

#### *3.4.4.2.8 Odor and Noise*

Odor and noise are not regulated in the ARM. Odor is a potential nuisance, but the project is not expected to increase odors. Noise is discussed in the subsequent section 3.19, *Sound, Electrical and Magnetic Fields, Radio and TV Effects*.

### 3.4.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

The maximum modeled concentrations of applicable NAAQS and MAAQS plus background concentrations in the two ventilation scenarios were very similar to those for Alternative 2 with AERMOD (Table 51). Model results differ from the Alternative 2 results by less than 15 percent. Maximum modeled concentrations ranged from 4 percent to 63 percent of the applicable NAAQS and MAAQS depending on the pollutant analyzed and the averaging period. Maximum concentrations modeled within the CMW for this scenario showed compliance with all applicable Class I increments (Table 51) (Sage Environmental Consulting 2007).

The Poorman Tailings Impoundment Site is about 1 mile south of the Little Cherry Creek Tailings Impoundment Site. The same control measures would be used at the impoundment to control fugitive dust. Effects of the Poorman Tailings Impoundment would be similar to Alternative 2. If control measures were not successful, the potential for fugitive dust to reach private land not owned by MMC would be greater in Alternative 3 and than Alternatives 2 or 4. Construction emissions and effects on air quality in Libby would be the same as Alternative 2.

### 3.4.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have essentially the same air emissions associated with underground exhaust and milling operations as Alternative 3. Concentrations of all pollutants would be below applicable standards. Effects from the tailings impoundment, road construction, and concentrate shipment would be the same as Alternative 2.

### 3.4.4.5 Alternative A—No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

**Table 51. AERMOD Modeled Concentrations Plus Background Concentration for Alternatives 3 and 4.**

| Pollutant | Averaging Period | PSD Class II Area (outside Cabinet Mountains Wilderness) | | PSD Class I Area (inside Cabinet Mountains Wilderness) | | Class I Increment |
|---|---|---|---|---|---|---|
| | | Libby Adits Only | Upper Libby Adit and Libby Adit | Libby Adits Only | Upper Libby Adit and Libby Adit | |
| $PM_{10}$ | Annual | 16.62 | 16.58 | 0.01 | 0.01 | 4.00 |
| | 24-Hour† | 51.69 | 51.67 | 0.13 | 0.20 | 8.00 |
| $PM_{2.5}$ | Annual | 4.82 | 4.79 | — | — | — |
| | 24-Hour† | 18.52 | 18.51 | — | — | — |
| $NO_x$ | Annual | 18.49 | 18.09 | 0.08 | 0.14 | 2.50 |
| | 1-Hour† | 352.97 | 352.97 | — | — | — |
| $SO_2$ | Annual | 4.26 | 4.25 | 0.003 | 0.003 | 2.00 |
| | 24-Hour† | 18.94 | 18.94 | 0.06 | 0.05 | 5.00 |
| | 3-Hour† | 45.35 | 45.35 | 0.28 | 0.27 | 25.00 |
| | 1-Hour† | 57.95 | 57.95 | — | — | — |

†High 2nd high values.
All units are in $\mu g/m^3$ (microgram per cubic meter).
Source: Sage Environmental Consulting 2007.

### 3.4.4.6 Effects Common to Alternatives B, C, D, and E

Construction of all transmission line alternatives would result in short-term increases in gaseous and particulate emissions. Similar, but lower, emissions would occur at the end of operations when the transmission line is removed. Concentrations of criteria pollutants would not exceed NAAQS or MAAQS.

### 3.4.4.7 Cumulative Effects

With the exception of the Libby Loadout, past actions in the analysis area have had little effect on ambient air quality in the analysis area. Wood burning and other human activity at the Libby Loadout have increased concentrations of particulate matter and other gaseous pollutants. All action alternatives for the transmission line would have similar cumulative impacts. Of the reasonably foreseeable actions described in section 3.3, *Reasonably Foreseeable Future Actions*, the Rock Creek Project on the west side of the Cabinet Mountains in the Rock Creek drainage would contribute to the cumulative effect on air quality. The Rock Creek Project would have similar emissions sources associated with the plant site, tailings impoundment, and other surface disturbances as the Montanore Project. The project would use diesel equipment in the mine and vent mine exhaust northeast of the plant site. Although an intake ventilation adit would be located in the CMW, it would not be a source of emissions.

The impact analyses conducted for the Montanore Project predicted compliance with the Class I and Class II increments at the CMW boundary. The Montanore and Rock Creek Projects have been analyzed and found to have a potential minor impact on ambient air quality. The geographic areas of impact for each project do not overlap, and therefore would not be additive. Thus, cumulative air quality impacts would not exceed the NAAQS or MAAQS.

Acid deposition impacts at sensitive lakes within the CMW from the Montanore Project were calculated independently from the Montanore MAQP Application. According to the 1992 EIS, "$NO_x$ and $SO_2$ increment consumption would occur from both projects (Rock Creek and Montanore), but the analysis indicates that there would not be a combined or overlapping increment consumption." This means that a small portion of the allowable increase in ambient air pollution concentrations under PSD Class I designations would occur as a result of each project. The increase would not be in the same geographic areas, and therefore would not be additive.

The Forest Service has monitored Libby Lakes for many years because of their high quality waters and sensitivity to change. There is concern that emissions from regional mining projects could increase acid deposition to the lakes, with acidification of the lake watershed and lake chemistry and associated adverse aquatic effects. The Forest Service conducted a MAGIC (Model of Acidification of Groundwater in Catchments) model screen analysis for CMW watersheds to determine the risk of both projects on Libby Lakes (Story 1997). The modeling results concluded the estimated changes in acid anions and base cations are not sufficient to project any changes in pH or alkalinity in Libby Lakes from either project directly, and cumulatively. The relatively low concentrations of emissions resulted in small changes in nitrogen and sulfur deposition to the Libby Lakes. The current estimated $NO_x$ and $SO_2$ emissions from the Montanore Project (Table 49) are lower than the emissions used for the MAGIC model screen analysis. Therefore, the model results are very conservative.

The Forest Service MAGIC modeling is consistent with the AQRV Modeling Analysis Results that calculated maximum sulfur and nitrogen deposition impacts from sources of $SO_2$ and $NO_x$ operating during Montanore Project production (TRC Environmental Corp. 2006b). Impacts were assessed at three sensitive water bodies identified by the DEQ: Lower Libby Lake, Upper Libby Lake, and Rock Creek. Deposition rates at these locations were used in ANC calculations and used as representative of the CMW for overall deposition analysis. Maximum nitrogen deposition impacts from the Montanore Project were found to be greater than the DAT [of NPS], and sulfur deposition impacts were found to be less or equal to DAT. All impacts were below the Forest Service levels of concern. The change in ANC is below applicable Forest Service LAC thresholds at all water bodies analyzed.

Timber harvesting, thinning, and prescribed burning associated with the proposed Miller-West Fisher Vegetation Management Project on unpaved roads would increase particulate emissions for a short duration. Concentrations of criteria pollutants would be well below the NAAQS and MAAQS. The cumulative effects of the two projects would not exceed the NAAQS and MAAQS. Other reasonably foreseeable actions in the area may be expected to contribute localized, short-term, and transient emissions of fugitive dust. The limited term nature of these potential emissions makes it unlikely that they would add measurably to emissions from the Montanore Project.

### 3.4.4.8 Regulatory/Forest Plan Consistency

All mine and transmission line alternatives would be in compliance with the KFP and the Montana Clean Air Act because construction activities and facility operations in all alternatives would not result in exceedances of any NAAQS or MAAQS.

### 3.4.4.9 Irreversible and Irretrievable Commitments

During construction and operation of the project, air pollutant concentrations would be higher throughout the analysis area and in the CMW than current levels, but below applicable air quality standards. Following mine closure and successful reclamation, pollutant concentrations would return to pre-mining levels. There would be no long-term irreversible or irretrievable commitment of resources.

### 3.4.4.10 Short-term Uses and Long-term Productivity

During construction and operation of the project, air pollutant concentrations would be higher throughout the analysis area and in the CMW than current levels, but below applicable air quality standards. Once mining and reclamation are completed, the pollutant concentrations would return to pre-mining levels, assuming adequate revegetation success.

# 3.5 American Indian Consultation

Federal laws, regulations, and treaties direct the Forest Service to consult with federally recognized tribes who may have concerns about federal actions that may affect religious practice, traditional cultural uses, and cultural resource sites and remains associated with American Indian ancestors. The analysis area lies within the aboriginal territory of the Kootenai Tribe. The Confederated Salish and Kootenai Tribes (CSKT) and the Kootenai Tribe of Idaho (KTOI) are the federally recognized tribes representing the modern members of the Kootenai Tribe.

### 3.5.1.1 Regulatory Framework

The Forest Service has a government-to-government responsibility to all federally recognized tribes, as outlined in the Guide to USDA Programs for American Indians and Alaska Natives (USDA 1997a). American Indian tribes are afforded consideration under the National Historic Preservation Act (Section 2) (NHPA), NEPA, the Native American Graves Protection and Repatriation Act (NAGPRA), the American Indian Religious Freedom Act (AIRFA), and the Religious Freedom Restoration Act (RFRA), among other Executive orders and policy. Federal guidelines direct federal agencies to consult with modern American Indian tribal representatives and traditionalists who may have concerns regarding federal actions potentially affecting religious practices, and other traditional cultural uses. Consultation also may involve cultural resource sites and remains associated with American Indian heritage. Any tribe whose aboriginal territory falls within a analysis area is afforded the opportunity to voice concerns for issues governed by NHPA, NAGPRA, AIRFA, and RFRA.

AIRFA protects the "inherent right of the freedom to believe, express, and exercise their traditional religions" (P.L. 95-442, 92 Stat. 1065; 7 U.S.C. 2269). These concerns include, but are not limited to, access to sites, use and possession of sacred objects, and the freedom to practice sacred ceremonies. RFRA (P.L. 103-141) establishes a higher standard for justifying government actions that may impact religious liberties.

### 3.5.1.2 Treaty Rights

The analysis area is located within lands encompassed by the Hellgate Treaty of 1855. The Hellgate Treaty was signed between the United States and the Flathead, Upper Pend d'Oreilles, and the Kootenai Tribes, and the federal government has consultation responsibilities to ensure that the Tribes' reserved rights are protected. The treaty-reserved rights include the "right of taking fish at all usual and accustomed places, in common with citizens of the Territory, and of erecting temporary buildings for curing; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land". The District fits the description of "usual and accustomed places," and lies within the aboriginal territory of the Kootenai and the Salish (Flathead). Ongoing consultation with the CSKT ensures that tribal treaty rights are protected.

### 3.5.1.3 Analysis Area and Methods

The analysis area surrounds all mine facilities and the transmission line alternatives. Consultation with the KTOI and the CSKT has taken place from 1989 until present. In addition, the Coeur d'Alene and Kalispel Tribes were notified and an offer made for discussion about the project. The KTOI responded to the request, and met for discussion. The Kalispel Tribe responded that due to

the project being on the east side of the Cabinets, it was well outside of Kalispel aboriginal territory. They wanted to continue to receive correspondence about the project. The early consultation from 1989 to 1992 was conducted during the NEPA work associated with the original Montanore Project. While this Montanore Project EIS updates the NEPA work, the original Montanore Project EIS initially outlined the analysis area and therefore early consultation is relevant. The Montanore Project consultation resumed and extends from January of 2005 until present. The primary limitation of this analysis is dependent on the response received from the tribes. If the tribes decline to comment, then the information available for analysis is limited.

### 3.5.1.4 Affected Environment

#### *3.5.1.4.1 Historical Tribal Distributions*

Historically, the Kootenai Tribe was made up of seven bands, with four in Canada and three in the U.S. The three historic U.S. bands are: the Tobacco Plains Band, located around present-day Eureka, Montana; the Jennings Band, located around the confluence of the Kootenai and Fisher Rivers, and the Bonners Ferry Band, located around present-day Bonners Ferry, Idaho. The aboriginal territory of the bands of the Kootenai is an irregularly shaped parcel. The territory is bounded by a southeast-northwest line extending along the Continental Divide to the west side of Kootenay Lake in Canada. The boundary continues north of present-day Golden, British Columbia southward to the Clark Fork River, then follows eastward to the confluence of the Flathead and North Fork of the Flathead Rivers. In 1855, after U.S. negotiations with the Flathead (Salish), Upper Pend d'Oreilles, and the Kootenai Tribes, the Jennings and Tobacco Plains bands were moved to the Flathead Reservation and became known as the CSKT. The Bonners Ferry Kootenai did not sign the Hellgate Treaty and it was not until 1974 that the Tribe was deeded 12.5 acres of land north of Bonners Ferry, Idaho.

#### *3.5.1.4.2 Consultation with Interested Tribes*

Consultation with tribes was initiated during scoping for the Noranda Montanore Project. The CSKT indicated an interest in the project and on December 8, 1989, the cultural resource inventory report was sent to the CSKT for review (Historical Research Associates 1989a and 1989b). In 1990, the CSKT and KTOI responded by outlining general concerns. The KTOI referenced treaty rights associated with huckleberry gathering, big game hunting, and stream fishing (December 6, 1990). The CSKT also referenced treaty rights including water quality issues, fish habitat, and more specifically copper contaminant effects on sturgeon (December 11, 1990). Information addressing these issues was relayed by the Forest Service with continued correspondence through 1991. Tribal consultation resumed under MMC's Montanore Project, with letters to the Tribal Chairmen for the CSKT, KTOI, the Kalispel and Coeur d' Alene Tribes dated July 18, 2005. The Kalispel Tribe responded that the project was outside of their aboriginal territory and therefore did not request further consultation (September 17, 2005). The Coeur d'Alene Tribe did not respond with interest in the project. Numerous meetings with the CSKT and KTOI took place to answer tribal questions and requests for information sent by the Forest Service. Written correspondence from the CSKT requesting that no mining be permitted was received on July 5, 2006 and July 9, 2007. Detailed correspondence is located in either the project record for Mines Management's or Noranda's Montanore Projects. Both project records are located in the KNF Supervisor's Office.

### 3.5.1.5 Environmental Consequences

The lead agencies identified three scoping issues for tribal consultation: 1) rights under the Hellgate Treaty; 2) sacred places and access to those places for the exercise of religion; and 3) burials. The thresholds indicated by the three issues could not be measured, as the tribes have declined to provide the baseline data necessary to conduct effects analysis.

#### *3.5.1.5.1 Alternative 1 – No Mine and Alternative A – No Transmission Line*

In this alternative, no actions are proposed, and any previously recorded or as yet undiscovered cultural sites with Tribal affiliation would remain undisturbed. The CSKT letter dated July 5, 2006 conveyed the tribal perspective on the Montanore Project, "Throughout the consultation process the Kootenai Elders have expressed a general desire to see no mining permitted on the KNF. The Elders remain concerned with the potential impacts (both direct and indirect) to water quality, fisheries, wildlife, plant life, and non-renewable cultural resources. The Kootenai people have traditional stories, place names, and cultural history throughout the area of impact. The Elders have also noted the influx of mine employees, equipment, and other mine related activity could have an impact on Tribal use of this area." This position was affirmed in another memo dated July 11, 2006.

#### *3.5.1.5.2 Effects Common to All Mine and Transmission Line Action Alternatives*

While the tribes were afforded the opportunity to provide comments on all alternatives, they declined, stating that their opposition to the Mine negated the need to determine which alternatives were more preferable to them.

#### *3.5.1.5.3 Cumulative Effects*

The CSKT considered the effects of the Montanore Project and the Rock Creek Project as one. The CSKT submitted the following comment regarding the Montanore Project: "The expansion of the Montanore Mine has the potential to impact Tribal ancestral sites, including trails, fishing and gathering areas, as well as occupation sites. Both mines have the potential to degrade water quality, thus impacting aquatic habitats that provide Tribal members with traditional plants and medicines. The degradation of the surrounding watershed should have far-reaching impacts on culturally significant fish and wildlife, including the endangered bull trout and white sturgeon" (July 11, 2006). The CSKT have chosen not to identify specific effects as requested by the agencies, so the agencies cannot address specific direct or indirect impacts to these undisclosed cultural resources. Analysis of cumulative effects described in other resource sections indicates that increased access to the general project area could increase the use of treaty-related resources by the general public as well as tribal members. Vegetation removal as a result of construction of the proposed project or other permitted activities within the Libby Creek watershed could impact areas of potentially significant plant species associated with tribal use. These potential effects to resources identified by CSKT are outlined in the various resource sections in this document.

#### *3.5.1.5.4 Regulatory/Forest Plan Consistency*

The consultation process for this project is consistent with direction in the KFP, and all other laws and regulations described in the section 3.5.1.1, *Regulatory Framework*. The KNF has consulted with tribes when management activities may impact treaty rights and/or cultural sites and cultural use.

### *3.5.1.5.5 Irreversible and Irretrievable Commitments*

The CSKT have stated their position that there would be irreversible and irretrievable impacts to non-renewable cultural resources. The specific resources referred to have not been disclosed to date.

## 3.6 Aquatic Life and Fisheries

This section describes changes to aquatic life and fisheries that may occur from the construction, operation, and reclamation of the Montanore Project. Existing conditions described in section 3.6.3, *Affected Environment* were determined through surveys and review of existing data sources and used to develop effects analysis for the fisheries resources in each watershed. Effects to fish populations were assessed based on effects to habitat.

### 3.6.1 Regulatory Framework

#### 3.6.1.1 Endangered Species Act

The KNF is required by the ESA to ensure that any actions it approves will not jeopardize the continued existence of a T&E species or result in the destruction or adverse modification of critical habitat. Agencies are also required to develop and carry out conservation programs for these species. The KNF will prepare a biological assessment (BA) that evaluates the potential effect on T&E species that may be present in the area. The BA will include any measures the KNF believes are needed to minimize or compensate for adverse effects on listed species. The KNF will submit the BA to the USFWS for review and consultation and the USFWS will issue a BO. Section 1.6.1.2, *U.S. Fish and Wildlife Service* provides more information on the BO.

Bull trout (*Salvelinus confluentus*) is currently listed as threatened under the ESA and occurs within the analysis area. The USFWS has designated bull trout critical habitat in six streams in the analysis area: Rock Creek, East Fork Rock Creek, Libby Creek, Poorman Creek, Ramsey Creek, and West Fisher Creek. Bull trout is discussed in section 3.6.3.9, *Threatened and Endangered Fish Species*.

White sturgeon (*Acipenser transmontanus*) is currently listed as endangered and occurs in the Kootenai River. The white sturgeon is restricted to 168 miles of the Kootenai River between Cora Linn Dam in Canada and Kootenai Falls in Montana. All proposed activities are upstream of Kootenai Falls. The proposed Libby Loadout in a disturbed area of the Kootenai Business Park east of Libby is the closest project facility to the Kootenai Falls. The proposed activities would have no effect on white sturgeon or its habitat, and is not discussed further.

#### 3.6.1.2 Major Facility Siting Act

The Major Facility Siting Act directs DEQ to approve a facility if, in conjunction with other findings, DEQ finds and determines that the facility minimizes adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives.

#### 3.6.1.3 Montana Water Quality Act

The Water Quality Act is the primary statute for water quality protection in the State of Montana. The DEQ enforces the Act, and the Act also provides authority for the establishment of surface water and ground water standards, mixing zone rules, and nondegradation rules.

#### 3.6.1.4 National Forest Management Act

The National Forest Management Act specifies that the National Forest System be managed to provide for diversity of plant and animal communities, based on the suitability and capability of the specific land area, in order to meet overall multiple-use objectives. Forest Service policy 9500-4 (FSM 2620.01) directs the Forest Service to: (1) manage "habitats for all existing native and desired non-native plant, fish and wildlife species in order to maintain at least viable populations of such species"; and (2) habitat must be provided for the number and distribution of reproductive individuals to ensure the continued existence of a species generally throughout its current geographic range.

The KFP (USDA Forest Service 1987) provides direction for meeting the requirements of the NFMA in its forest-wide goals and standards in chapter 1 (Volume 1) and in the Management Area (MA) direction in chapter III (Volume 1). The plan contains an overall forest-wide goal to provide sufficient quality and quantity of habitat for various species or groups of species within the suitability and capability of the forest to do so.

The KNF provides habitat for more than 300 different species of fish and wildlife (KIPZ Analysis of the Management Situation, USDA Forest Service 2003b: 45, 59-64), many of which occur on the Libby Ranger District and within the Montanore Project analysis area. The presence or absence of these fish and wildlife species depends on the amount, distribution, and quality of each species' preferred habitat. In addition to habitat changes, many of these are impacted by fishing, hunting or trapping. FWP regulates fish and game populations in the analysis area. The Forest Service and the FWP work together to ensure that an appropriate balance is maintained between habitat capability and population numbers. The Forest Service also works closely with the USFWS to assist in the recovery of species listed under the ESA. Proposed federal projects that have the potential to impact species protected by the ESA require consultation with the USFWS.

Sensitive species are managed under the authority of the NFMA and are administratively designated by the Regional Forester (FSM 2670.5). FSM 2672.42 directs the Forest Service to conduct a biological evaluation (BE) to analyze impacts on sensitive species. If any unmitigated, significant effects are identified in the BE, the Forest Supervisor must make a decision to allow or disallow the impact. If the significant effects would result in a significant trend toward federal listing, the Forest Supervisor cannot allow the project to proceed. The sensitive species analysis in this document meets the requirements for a BE as outlined in FSM 2672.42. Sensitive fish species identified within the analysis area are the interior redband trout (*Oncorhynchus mykiss gairdneri*) and the westslope cutthroat trout (*Oncorhynchus clarki lewisi*). Torrent sculpin (*Cottus rhotheus*) is a Species of Concern in the State of Montana, but no longer listed by Region 1 USDA Forest Service.

The KFP establishes forest-wide objectives, standards, guidelines, and monitoring requirements for KNF sensitive species. KFP direction for sensitive species includes determining the status of sensitive species and providing for their environmental needs as necessary to prevent them from becoming endangered.

#### 3.6.1.5 Kootenai Forest Plan

The KFP established management areas within the forest with different goals and objectives based on the capabilities of lands within this area (USDA Forest Service 1987). In 1995, the KNF

amended the KFP to adopt the Inland Native Fish Strategy (INFS) (USDA Forest Service 1995). As part of this strategy, the Regional Foresters designated a network of priority watersheds, which are drainages that still contain excellent habitat or assemblages of native fish, provide for objectives of stable or increasing fish populations, or have excellent potential for restoration. The priority watersheds in the analysis area are Rock Creek, Bull River, West Fisher Creek, and Libby Creek. The area of Libby Creek designated as a priority watershed is Libby Creek and all tributaries upstream of U.S. 2.

To implement this strategy, INFS also established stream, wetland and landslide-prone area protection zones called Riparian Habitat Conservation Areas (RHCAs). INFS standards apply only to National Forest System lands. RHCAs are portions of watersheds where riparian-dependent resources receive primary emphasis. INFS sets standards and guidelines for managing activities that potentially affect conditions within the RHCAs, and for activities outside of RHCAs that potentially degrade RHCAs. These standards and guidelines are in addition to existing standards and guidelines in the KFP. RHCAs are defined for four categories of stream or water body, depending on flow conditions and presence of fish, with different RHCA widths for each category (Table 52). The widths shown in Table 52 are minimum widths. For fish-bearing streams, RHCAs extend from the edge of both sides of the active stream channel to the outer edges of the 100-year floodplain, to the outer edge of the riparian vegetation, to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet, include both sides of the stream channel), whichever is greatest. Widths of RHCA buffers are based on current scientific literature that documents them to be adequate to protect streams from non-channelized sediment inputs (sediment produced from overland flow) and provide for other riparian functions. These riparian functions include delivery of organic matter, large woody debris recruitment, and stream shading. All four categories are represented by streams and waterbodies in the analysis area.

**Table 52. RHCA Categories and Standard Widths.**

| Stream or Waterbody Category | Standard Width |
|---|---|
| Fish-bearing streams | Minimum 300 feet each side of the stream |
| Perennial, non-fish bearing streams | Minimum 150 feet each side of stream |
| Ponds, lakes, and wetlands greater than 1 acre | Minimum 150 feet from maximum pool elevation |
| Intermittent and seasonally flowing streams, wetlands less than 1 acre, landslides and landslide prone areas | Minimum 50 feet from edge (except in priority watersheds, where the minimum is 100 feet) |

Source: USDA Forest Service 1995.

In addition, INFS identifies riparian management objectives (RMOs) that guide management of key habitat variables for good fish habitat on National Forest System lands. The RMOs for stream channel conditions provide the criteria against which attainment or progress toward attainment of riparian goals is measured. RMOs, as established by INFS standards for forested systems, include pool frequency, large woody debris (LWD) frequency, and width/depth ratio (Table 53). Actions that retard attainment of these RMOs, whether existing conditions are better or worse than

objective values, are considered to be inconsistent with INFS and therefore not in compliance with the KFP.

**Table 53. Habitat Measures associated with Riparian Management Objectives Standards.**

| Habitat Measure | | Riparian Management Objectives Standard | | |
|---|---|---|---|---|
| Bankfull Width (ft) | Pools per Foot | Large Woody Debris per Foot (>BFW) | Bank Stability (%) | Width/Depth Ratio |
| <10 | 1 per 55 | 1 per 250 | >80 | <10 |
| 10-20 | 1 per 94 | 1 per 250 | >80 | <10 |
| 20-25 | 1 per 112 | 1 per 250 | >80 | <10 |
| 25-50 | 1 per 203 | 1 per 250 | >80 | <10 |

BFW = Bankfull width.
Source: USDA Forest Service 1995.

INFS included project- and site-specific standards and guidelines that apply to all RHCAs on National Forest System lands and to projects and activities outside RHCAs on National Forest System lands that have the potential to degrade RHCAs. Some of the standards and guidelines require that activities not retard or prevent the attainment of the RMOs. "For the purposes of analysis, to 'retard' would mean to slow the rate of recovery below the near natural rate of recovery if no additional human-caused disturbance was placed on the system. This obviously will require professional judgment and should be based on watershed analysis of local conditions" (USDA Forest Service 1995). Section 3.6.4.11, *Regulatory/Forest Plan Consistency,* discusses compliance with the following RHCA standards and guidelines:

- Timber management (TM-1)
- Roads management (RF-2 through RF-5)
- Minerals management (MM-1, MM-2, MM-3, and MM-6)
- Lands (LH-3)
- General riparian area management (RA-2 through RA-4)
- Watershed and habitat restoration (WR-1)
- Fisheries and wildlife restoration (FW-1)

## 3.6.2 Analysis Area and Methods

### 3.6.2.1 Analysis Area

The analysis area includes areas where aquatic resources may be affected either by mine construction, operations, and closure or by construction, maintenance, and decommissioning of the transmission line. Mine alternatives may affect the named and unnamed streams in the East Fork Bull River, Rock Creek, Ramsey Creek, Poorman Creek, Bear Creek, Libby Creek, and

Little Cherry Creek watersheds. The transmission line corridor area is drained by the Fisher River and its tributaries: Hunter Creek, Sedlak Creek, Miller and North Fork Miller creeks, Standard Creek, and West Fisher Creek; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the analysis area. Short segments of the Miller and West Fisher Creek transmission line alternatives would be within the Standard Creek watershed, but the line and any associated access roads would be located more than 1 mile from the creek and not within any RHCA. No effects on Standard Creek are expected, and it is not discussed further. Only minor disturbance would occur in Midas Creek from the North Miller Creek and Modified North Miller Creek transmission line alternatives. Disturbance would be limited to the upper part of the watershed, would not occur within an RHCA, and would be unlikely to affect aquatic life. Thus, impacts in Midas Creek are not discussed in detail. Proposed activity in other watersheds would be minimal and would have no potential for adverse effects on fish species and other aquatic organisms; these watersheds are not discussed further in this section.

Lakes included in the analysis area are Rock Lake and St. Paul Lake (Figure 53). Libby Lakes are not expected to be affected by the proposed project and Ramsey Lake does not provide aquatic habitat; these lakes are not discussed further.

### 3.6.2.2 Baseline Data Collection

#### *3.6.2.2.1 Data Sources*

The FWP's Montana Fisheries Information System (MFISH) database (FWP 2008a) and the 1992 Montanore Project Final EIS (USDA Forest Service *et al.* 1992) were the primary sources used to determine fish distribution in the analysis area. The 1992 Final EIS also provided data on benthic macroinvertebrate and periphyton populations, as did additional surveys that were conducted at a limited number of sites in 1990 through 1994 as part of an interim monitoring program (Western Technology and Engineering 1992, 1993, 1994; Western Technology and Engineering and Phycologic 1995). Fish distribution surveys, fish genetic analyses, and habitat surveys have also been performed from before the initial baseline period up through 2005, mainly by the FWP. Results of most of these surveys were summarized by Kline Environmental Research (2004). Additional data were used from habitat and fish surveys conducted on the East Fork Bull River and Rock Creek between 1992 and 1994 (Washington Water Power Company 1996), and on the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000). Annual data on fish distribution, abundance, spawning surveys, and aquatic habitat surveys have been gathered by Avista Corp. (Avista) in East Fork Bull River and Rock Creek drainages from 1999 to 2008 for their hydropower relicensing agreement (GEI 2005; Hintz and Lockard 2007; Horn and Tholl 2008; Lockard *et al.* 2008; Storaasli and Moran 2008). Descriptions and data for Rock Creek from the Rock Creek Project Final EIS were used (USDA Forest Service and DEQ 2001).

The most recent aquatic resources data used were from surveys conducted in 2005 to supplement the existing data. These data focused on fish distribution, habitat quality, location and navigability of culverts and other barriers, composition of spawning gravel, stream temperature, and the comparison of fish habitat quality in Little Cherry Creek and in the proposed drainage diversion (Kline Environmental Research 2005a, 2005b; Kline Environmental Research and Watershed Consulting 2005a, 2005b; Kline Environmental Research, ADC Services and Watershed

Consulting 2005; Watershed Consulting and Kline Environmental Research 2005). Additional data from Avista include data for the East Fork Bull River and Rock Creek through 2007.

#### *3.6.2.2.2 Habitat Survey*

During the initial baseline study period in 1988, physical habitat was evaluated at 18 stream reaches located on Libby, Little Cherry, Ramsey, Poorman, Bear, and East Fork Rock creeks. The habitat surveys classified stream reaches using the USDA Forest Service General Aquatic Wildlife System Level III assessment (USDA Forest Service 1989), which incorporates the Rosgen (1985) channel-typing system. This system categorizes reaches based on various measurements of entrenchment, width-to-depth ratio, sinuosity, substrate, and stream slope. The Forest Service also used this method to characterize a more limited number of reaches in these streams in 1997, 1998, 2002, 2004, and 2005 (Kline Environmental Research 2004; USDA Forest Service 2005).

Habitat surveys were conducted on Rock Creek and the East Fork Bull River between 1992 and 1994 (Washington Water Power Company 1996) as part of a survey of the lower Clark Fork River tributaries. Various habitat variables were recorded, including but not limited to: average widths, average depths, maximum pool depths, bank stability, substrate composition, amount of large woody debris, and percentage of surface fines. Temperature at the time of sampling was recorded and the spawning area substrate composition and spawning habitat availability were evaluated. The Lower Clark Fork Habitat Problem Assessment (GEI 2005) summarized habitat surveys in the East Fork Bull River from 1993 to 2003 and habitat work in Rock Creek. The Rock Creek Project Final EIS used these data and also summarized similar habitat data from additional sources (USDA Forest Service and DEQ 2001).

Stream habitat surveys also were conducted in the Libby Creek watershed in July and August 2005 during base flow conditions at most sites shown in Figure 53. Site LC4 was not surveyed because it had only isolated, shallow pools as habitat. Survey protocols followed USDA Forest Service Level III Region 1/Region 4 fish habitat inventory procedures (Overton *et al.* 1997), and are described by Watershed Consulting and Kline Environmental Research (2005). Habitat units at each site were identified, with various measures such as length, width, average and maximum depths, number of pools, pool type, substrate composition, percent stable and undercut banks, and amount of large, woody debris existing in the stream channel recorded for each unit.

A more extensive habitat survey was conducted in May and June 2005 for Little Cherry Creek and Channels A and B, proposed to receive flows of diverted Little Cherry Creek in Alternatives 2 and 4. Methods used to collect the data were generally based on Bain and Stevenson (1999), with aspects of the USDA Forest Service methods incorporated to address the biological and physical variables determined to be essential for bull trout (USDA Forest Service 1998b). This survey documented distance, elevation, macrohabitat type, pool dimensions, large woody debris, substrate, valley slope and width, and riparian characteristics continuously along the entire length of the creek. The five habitat characteristics that could be documented in Channels A and B (channel gradient, valley side gradient, flood prone width, riparian type, and large, woody debris) also were surveyed to allow for comparisons between what currently exists in Little Cherry Creek and what could be predicted to develop in the two channels (Kline Environmental Research 2005a).

Separate surveys were conducted that documented culverts and potential fish barriers in Libby Creek upstream of NFS road #231 (Libby Creek Road), and the full length of Little Cherry Creek, Poorman Creek, and Ramsey Creek (Kline Environmental Research 2005b; Kline Environmental Research *et al.* 2005). Culverts were surveyed and analyzed for their potential to block upstream passage of fish. All other fish barriers were photographed, described, and measured for breadth, height, and plunge pool depth. Once a permanent barrier to all fish under all flow conditions was identified on each tributary, the survey effort was discontinued. Kline Environmental Research (2005b) describes the methods used to characterize the barriers.

Stream gravel samples were collected from 15 sites on Libby, Little Cherry, Poorman, Bear, and Ramsey creeks using a McNeil core sampler (Kline Environmental Research and Watershed Consulting 2005b). Samples were collected in July and August 2005 from all locations shown in Figure 53, except for sites Be2, LC4, and L9. The sites on Bear Creek and Libby Creek were not sampled at that time because McNeil core samples had recently been collected in 2004 and 2005 by the FWP or USDA Forest Service at or near those locations (Wegner, pers. comm. 2006a). The upstream Little Cherry Creek site was not sampled for gravel because only isolated, shallow pools for fish were present at the site, and no fish were observed at the site immediately downstream. When sufficient quantities of gravel were present, 10 core samples were collected from each reach with the McNeil sampler. A more complete description of methods used to collect and process the gravel samples is given by Kline Environmental Research and Watershed Consulting (2005b).

The Fisher River was surveyed in 2003 and Miller Creek was surveyed in 1998 and 2005 by the KNF. These surveys provided information on Rosgen channel type, gradient, width/depth ratio, and substrate composition.

#### *3.6.2.2.3 Periphyton Population Survey*

Periphyton populations were sampled in analysis area streams during August 1988, October 1988, and April 1989 as part of the initial baseline study. Interim monitoring continued during 1990 and 1991 at all locations in the analysis area, and during 1993 and 1994 at Libby Creek sites only. The objective of the continued monitoring was to assess possible impacts of exploration activities during 1991 and elevated concentrations of nitrate in Libby Creek.

Collection of the samples involved scraping algae from a variety of substrates and combining those scrapings to compose one sample per site. Non-diatom algae were identified to genus, with relative abundances of each taxon estimated as rare, common, very common, abundant, or very abundant. Diatoms were identified to species, with percent relative abundances calculated when possible. Full descriptions of methods used for each sampling event are documented by Western Resource Development Corp. (1989a); Western Technology and Engineering (1992, 1993, 1994); and Western Technology and Engineering and Phycologic (1995).

#### *3.6.2.2.4 Macroinvertebrate Population Survey*

Stream macroinvertebrates were collected from 21 locations in analysis area streams between 1986 and 2004 (Western Resource Development Corp. 1989a; USDA Forest Service and DEQ 2001; Western Technology and Engineering 1991, 1992, 1993, 1994; Western Technology and Engineering and Phycologic 1995; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006). Some reaches were sampled up to 23 times over that time period. Sampling began

in 1988 in Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, and East Fork Rock Creek for the purpose of collecting the initial baseline data for the project. Interim sampling continued through 1994 at a more limited number of reaches in these streams to assess possible impacts of mining activities that occurred during 1991. Additional macroinvertebrate data were collected from a single reach in Libby Creek in 2000 and 2003 in order to evaluate the effects of a restoration project that was completed during that time period (Hoffman *et al.* 2002; Dunnigan *et al.* 2004). The KNF conducted sampling annually at four to six reaches on Libby Creek, Bear Creek, West Fisher Creek, and the Fisher River since 1998 (USDA Forest Service 2006). Macroinvertebrate sampling in East Fork Rock Creek occurred in 1986 through 1988 as part of the Rock Creek Project permitting.

Sampling methods differed over this time period in number of samples taken per site, type of equipment used to collect and process samples, and level of identification used for certain macroinvertebrate families. The differences in methods used complicate the ability to interpret any changes in population parameters over time.

#### *3.6.2.2.5 Fish Population Survey*

During 1988 and 1989, fish populations at 13 sites on Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, and the East Fork Rock Creek were sampled using backpack electrofishing equipment. Additionally, Rock Lake was sampled using gill nets and hook and line, and Rock Creek Meadows, a large wetland on East Fork Rock Creek below Rock Lake, was sampled using an electrofishing boat and hook and line. Sampling occurred in August and September 1988. Sites were generally between 330 to about 1,000 feet in length. Each fish collected was identified, weighed, and measured, and scales were taken from most fish to provide estimates of age and growth. Spawning was assessed from electrofishing results and from visual searches along Libby, Ramsey, and Poorman creeks conducted in October 1989.

Heavy metals analyses of rainbow trout (*Oncorhynchus mykiss*) tissues collected from the most downstream site on Libby Creek were conducted at Montana State University, Bozeman, and the Department of Health and Environmental Sciences, Helena, Montana (Western Resource Development Corp. 1989a).

Additional surveys have been conducted on analysis area streams and lakes by the FWP and others. The results of most of these surveys are summarized by Kline Environmental Research (2004), with additional survey results listed in the MFISH database (FWP 2008a). Fish population surveys also were conducted on the East Fork Bull River and Rock Creek between 1992 and 1994 (Washington Water Power Company 1996), and on the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000) as part of projects surveying the lower Clark Fork River tributaries and the Bull River drainage. From 2000 through 2007, fish surveys were completed on the East Fork Bull River and from 2001 through 2007 on Rock Creek by Avista (Horn and Tholl 2008). Results of fish surveys conducted in Rock Creek from 1985 through 1996 and the results from metals analyses of trout tissue collected from Rock Creek in 1985 are summarized in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). As part of the mitigation efforts for the construction and operation of Libby Dam, fish population surveys also were conducted on Libby Creek from 2000 through 2004. Spawning surveys were conducted annually on Bear Creek from 1995 through 2004 as part of the same project (Dunnigan *et al.* 2004, 2005). During July and August 2005, day and night snorkel surveys were conducted at most 2005 sample

sites shown in Figure 53. Site LC4 was not surveyed because only shallow, isolated pools were present at that location, and because no fish were observed downstream at site LC3. Sites Be2, L9, L10, and L11 were not surveyed because fish surveys have been conducted near these reaches during 2003, 2004, or 2005 by government agencies (Kline Environmental Research and Watershed Consulting 2005a). Two of the Little Cherry Creek sites, sites LC1 and LC3, were too shallow for snorkeling, and were instead surveyed visually from the banks. For each macrohabitat type within each stream reach, counts of fish, species identifications, and lengths were documented to the extent practical without capturing fish. Kline Environmental Research and Watershed Consulting (2005a) provides a more complete description of methods used.

##### *3.6.2.2.6 Riparian Habitat Conservation Areas and Other Riparian Areas*

The KNF maintains a map of RHCAs for the Libby Ranger District, which is available in the agencies' project record. Most streams within the analysis area are considered fish-bearing streams under INFS. RHCAs also are found around wetlands (Table 52). Wetlands in the analysis area were "buffered" by the standard widths shown in Table 52 to generate a final RHCA and other riparian area map (Figure 54). Similar habitat is found on private land in the analysis area. Such habitat is described as "other riparian areas" in the impact assessment.

### 3.6.2.3 Impact Analysis Methods

The impact analysis methods focused on assessing the effects to fish, fish habitat, and other aquatic populations from the predicted changes in sedimentation rates, water quantity, water quality (nutrients and toxic metals), fish passage, and fish losses. Additionally, the effects of these changes on sensitive species, including threatened species and species of special concern, were assessed.

#### *3.6.2.3.1 Sediment*

Mine construction, mine activities, and transmission line construction may result in increased sediment in streams. Possible sources of sediment related to the proposed project were identified for the three phases of mine activities: construction, operation, and post-operation. The amount of sediment that may reach analysis area streams from these sources could not be quantified, but best professional judgment was used to assess the likely conditions under which sediments could be released into analysis area streams and the effects of these releases on stream habitat for each alternative. The possible changes to stream habitat that may occur from increased sedimentation rates were then evaluated as to their possible effect on fish and other aquatic populations within the analysis area.

#### *3.6.2.3.2 Water Quantity*

The water bodies in the study area include first-order headwater streams to larger second-order streams, as well as many glacial lakes whose water sources are snowmelt, rainfall, and ground water (hallow and deep). Streamflows are described in section 3.11, *Surface Water Hydrology*.

Continuous flow records are not available to adequately describe existing flow conditions or the range of natural variability in flow for any of the streams within the analysis area. The KNF maintains a continuous flow monitoring site on Libby Creek near U.S. 2, but it is outside of the analysis area. Only occasional flow measurements, summarized in Table 84, supplemented with calculated 7-day/10-year ($7Q_{10}$) flows for selected sites (see section 3.12.2.3.2, *Water Quantity* for $7Q_{10}$ discussion), were used to evaluate the effects of water quantity on fisheries habitat.

Section 3.10, *Ground Water Hydrology* describes how mine and adit inflows and the resulting ground water drawdown may impact base flow in streams that drain the mine area. Possible reduction in base flow is discussed in section 3.10.4, *Environmental Consequences*.

The analysis of changes in streamflow as a result of mining on fisheries habitat is a qualitative assessment based on best professional judgment and available data. Data to quantitatively assess or model changes in available habitat under existing and alternative flow conditions are not available. The analysis of flow-related habitat effects focuses on the threatened species, bull trout, but considers other species of concern (westslope cutthroat or interior redband trout) when needed. The basic assumption was made that reduced base flows potentially would have the greatest effect on bull trout populations by directly affecting their preferred spawning habitat. Similarly, any modest increase in base flows would benefit bull trout spawning habitat (see section 3.10, *Ground Water Hydrology* for discussion of base flow). Depending upon local conditions, bull trout generally spawn between September and October, in relatively deep gravel substrate that is heavily influenced by discharging ground water flow. Ground water seeps provide stable flow with consistent temperature regimes that are conducive for the 7- to 8-month egg-to-fry maturation cycle for bull trout (MBTRT 2000). Environmental factors that can affect the survival rate of bull trout eggs or fry include, but are not limited to, scouring due to high seasonal flows, freezing due to low flows, or sediment deposition. Sufficient deep ground water flow plays a pivotal role in the survival of bull trout eggs and fry development by mitigating these potential mortality factors (MBTRT 2000).

Basic descriptive statistics of the available measured and calculated flow ($7Q_{10}$), along with graphical presentations of measured flow, were examined for the critical flow period for bull trout (*i.e.*, the spawning period of September through October) to evaluate potential effects. The $7Q_{10}$ values were used in the habitat effect analysis because they approximate the worse case scenario given annual precipitation. Potential flow conditions during other times of the year were evaluated on a case by case basis depending upon available data.

Six possible mechanisms related to the mine operations may induce flow-related habitat changes. The first mechanism is effects to stream base flow due to mine and adit inflows. A second mechanism is related to the infiltration from the LAD Areas into the shallow ground water system and eventually into streams located downgradient. The third mechanism is related to the tailings impoundment, which would divert precipitation intercepted by the impoundment to the mill for subsequent reuse. Fourth, flow-related habitat changes may be affected by storm water runoff from the mine facilities. Fifth, make-up water may be needed if mine and adit inflows were not sufficient for mill operations. A sixth mechanism is that peak flow would be affected by vegetation clearing and road densities. None of the transmission line alternatives would affect streamflow.

#### *3.6.2.3.3 Water Quality*

Projected changes in water quality during low flow conditions and the three operation phases (construction, mining, and post-mining) were compared to existing median water quality concentrations at various locations on Ramsey Creek, Poorman Creek, Little Cherry Creek, and Libby Creek. Methods used in the mass balance calculations for prediction of water quality changes are discussed in section 3.12.2.3, *Impact Analysis*. It is unlikely that there would be any measurable change in the water quality of Rock Creek, the East Fork Bull River, or Libby Lakes.

Rock Lake and St. Paul Lake may become more dilute, with lower dissolved mineral concentrations (Gurrieri 2001).

**Nutrients**

The DEQ has not developed nutrient criteria recommendations for the protection of aquatic life applicable to the analysis area. Therefore, projected concentrations were compared to existing concentrations and the ecoregional reference condition established for nutrients by the EPA (Environmental Protection Agency 2000). The analysis area is located in nutrient ecoregion II, subecoregion 15, which has a reference condition of 0.2 mg/L for total nitrogen.

In 1992, the BHES issued an Order authorizing degradation and establishing allowable changes in surface and ground water quality adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established numeric nondegradation limits for total organic nitrogen as 1.0 mg/L total inorganic nitrogen (TIN) (see section 3.12.1.1.1, *Board of Health and Environmental Sciences Order No. 93-001-WQB*). In issuing the Order, the BHES determined that a limit of 1 mg/L TIN would be protective of all beneficial uses (BHES 1992). In 1992, the DHES (now DEQ) determined that land treatment would provide adequate secondary treatment of nitrate (80 percent removal). The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved and the TIN concentration in Libby, Ramsey, or Poorman creeks would not exceed 1 mg/L. The Order also adopted the modifications developed in Alternative 3, Option C, of the Final EIS (1992), addressing surface and ground water monitoring, fish tissue analysis, and instream biological monitoring. In all alternatives, the agencies assumed TIN concentrations (ammonia plus nitrate) could increase up to 1 mg/L. Existing TIN concentrations were not measured.

The greatest ecological effect of increased nutrient concentrations would be an increase in primary production potentially resulting in nuisance algal blooms either in the channel or downstream of the discharge. This analysis examined changes in nitrogen concentrations in the Libby Creek watershed, although nitrogen is only one of the factors that could influence production in the stream. Phosphorus is generally the limiting factor to production in this region and recent phosphorus data suggest low levels in the analysis area. Other factors, such as carbon, shading, stream velocity, and substrate composition can also limit algal production.

Ammonia is the only nutrient with known toxicity to aquatic life and has established aquatic life standards (ALS). Chronic criteria for ammonia are modified by ambient pH and temperature, and take into consideration the presence of sensitive early life stage fish. The presence of early life stage fish requires a more restrictive standard. Higher temperatures also result in a more restrictive standard. For an effects evaluation, projected changes in ammonia concentrations were compared to the chronic early life stage present criterion at ambient pH and temperature of 14°C.

To evaluate the magnitude of change in nutrient concentrations, an enrichment ratio (ER) was calculated for each parameter as the projected concentration divided by the existing concentration. An ER equal to one indicates no expected change in concentration, less than one indicates an expected decrease in concentration, and greater than one indicates an expected increase in concentration. Only minor differences in nutrient concentrations would be expected during the three phases of operation; predicted impacts are discussed collectively.

**Metals**

Existing baseline and projected concentrations were available for total dissolved solids and several metals. The impact assessment for aquatic life focuses on two metals: copper and zinc. Copper and zinc are the focus of the aquatic life assessment because they have nondegradation limits set by the BHES Order, are found more frequently in area streams at concentrations above the detection limit, and would be in concentrations above the detection limit in discharged wastewater. Manganese was not included in the assessment, although it does have a BHES Order nondegradation limit in surface water. The BHES Order nondegradation limit of 0.05 mg/L in surface water was consistent with the Montana surface water quality standard in effect in 1992. Montana's surface water standard for manganese was designed to protect the beneficial use of surface water as a drinking water source. Manganese in drinking water can have adverse staining and taste characteristics. Montana currently does not have a surface water quality standard for manganese, nor an aquatic life standard (Table 94). The hardness-modified manganese standard of 1.04 mg/L for aquatic life adopted by Colorado (Stubblefield and Hockett 2000) was used to evaluate potential effects of projected manganese concentrations, which is a better indicator of potential harm to aquatic life than the BHES Order nondegradation limit of 0.05 mg/L. Manganese concentrations in surface water in all alternatives would be well below Colorado's standard protective of aquatic life and manganese is not discussed further.

Although monitoring would be required for a full suite of metals (see Appendix C), accurate predictions of instream concentrations of other metals resulting from Montanore discharges and the effect on aquatic life cannot be made. The other metal concentrations, in both receiving streams and in wastewater to be discharged, are frequently below the detection limit. The uncertainties associated with projected instream concentrations resulting from Montanore discharges are discussed in section 3.12.2.4, *Uncertainties Associated with the Water Quality Assessment*.

To determine potential effects of changes in copper and zinc concentration to aquatic life, projected instream concentrations for each alternative were compared to Montana numeric ALS (DEQ 2006b). The most current Montana ALS were used for comparisons (DEQ 2008a). Montana ALS for copper and zinc are stream hardness-modified values. Because the toxicity-hardness relationship is uncertain at hardness concentrations of less than 25 mg/L, a hardness value of 25 mg/L as $CaCO_3$ is used to calculate metals standards when ambient hardness is less than 25 mg/L (DEQ 2006b). Ambient hardness is less than 10 mg/L in many of the water quality monitoring locations, creating additional uncertainty for the analysis of effects of metals on fish. Existing metals concentrations are presented as total recoverable metal and, therefore, were compared to total metal standards when available.

Similar to the nutrient evaluations, ERs were determined for copper and zinc to quantify the magnitude of change from existing conditions to the projected concentrations. Only minor differences in metals concentrations would be expected during the three phases of operation; therefore, predicted impacts are discussed collectively.

### *3.6.2.3.4 Toxic Metals in Fish*

Metal concentrations in fish tissues were determined from rainbow trout samples collected from Libby Creek downstream of the Little Cherry Creek confluence (Western Resource Development Corp. 1989a). Metals measured included cobalt, copper, lead, mercury, and zinc in fish ranging

from 3 inches to greater than 7 inches. All reported concentrations were assumed to be reported as wet weight. Potential changes in tissue concentrations for each alternative were not calculated due to the lack of information needed to determine site-specific bioaccumulation and bioconcentration factors. Rather, effects due to an increase in metal tissue concentrations were evaluated through projected changes for instream metals concentrations.

##### *3.6.2.3.5 Fish Passage and Fish Loss*

Mine activities have the potential for altering stream habitat by the creation of barriers to fish passage. If fish passage is restricted, habitat may be fragmented, migratory corridors may be eliminated, and fish subpopulations can become isolated from the remainder of the population. If a fish population becomes isolated, neighboring populations may be unable to recolonize and act as a source of gene flow for the isolated population, leaving it more vulnerable to extirpation. In several Montana watersheds, lack of connectivity has been identified as a major threat to bull trout restoration and persistence (Parametrix 2005). The likelihood that physical or flow barriers would develop in the analysis area and the potential effects of the development of those barriers were assessed using best professional judgment. Additionally, mine actions and mitigation plans were evaluated with respect to their potential to cause loss of fish within the analysis area.

##### *3.6.2.3.6 Threatened, Endangered, or Sensitive Species*

As part of the impact analysis, activities during mine construction, operation, and post-operation were evaluated to determine their potential to alter stream habitat in such a way as to adversely affect sensitive species. Threatened, endangered, or sensitive fish species include the bull trout, a federally listed threatened species, and interior redband trout and westslope cutthroat trout, all of which are species of special concern in Montana. Trout have specific habitat requirements for spawning, egg incubation, and rearing of juvenile fish, and possible effects on habitat must be assessed for all life stages. Best professional judgment was used to determine the potential for any adverse effects of mine activities to occur.

## 3.6.3 Affected Environment

### 3.6.3.1 Habitat

#### *3.6.3.1.1 Stream Habitat Characteristics*

Fish habitat parameters for 15 stream reaches within the analysis area sampled in 2005 are summarized in Table 54, with more detailed data summaries provided by Watershed Consulting and Kline Environmental Research (2005). Additional data from the KNF on Libby Creek and its tributaries are presented in Table 55. The habitat evaluations conducted in Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, and East Rock Creek during the initial baseline study period in 1988-1989 classified each stream reach using the Rosgen (1985, 1996) system. Figure 55 shows the Rosgen categories assigned to each reach during the initial baseline surveys and additional studies. If the same reach was surveyed for two or more years, then the category assigned to that reach during the most recent survey is given.

**Table 54. 2005 Region 1/Region 4 Summary Data for 15 Stream Reaches.**

| Site | Study Length (ft) | Gradient (%) | Width/ Depth Ratio | Percent Riffle | Per-cent Run/ Glide | Per-cent Pool | Pools/ mile | LWD/ mile | Per-cent Stable Banks | Percent Undercut Banks |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Libby Creek*** | | | | | | | | | | |
| L1 | 997 | 1.8 | 50.9 | 48.3 | 28.1 | 28.6 | 10.3 | 31.9 | 100.0 | 0.0 |
| L2 | 928 | 1.5 | 104.7 | 52.0 | 23.2 | 24.8 | 4.4 | 22.8 | 100.0 | 0.2 |
| L3 | 1000 | 3.5 | 39.4 | 64.2 | 20.2 | 15.6 | 12.2 | 153.0 | 100.0 | 2.8 |
| L9 | 1000 | 1.5 | 48.1 | 56.8 | 24.3 | 18.9 | 10.2 | 126.8 | 100.0 | 0.0 |
| L10 | 1000 | 4.0 | 39.4 | 70.6 | 9.8 | 16.4 | 12.2 | 73.9 | 100.0 | 0.2 |
| L11 | 1000 | 15.0 | 27.7 | 69.9 | 9.5 | 12.0 | 10.2 | 26.4 | 100.0 | 0.0 |
| ***Bear Creek*** | | | | | | | | | | |
| Be2 | 1066 | 2.0 | 32.9 | 77.7 | 6.1 | 16.2 | 11.5 | 153.5 | 99.7 | 0.1 |
| ***Little Cherry Creek*** | | | | | | | | | | |
| LC1 | 902 | 1.5 | 32.1 | 49.2 | 27.4 | 23.5 | 24.9 | 177.2 | 100.0 | 0.1 |
| LC2 | 971 | 2.0 | 28.2 | 46.1 | 26.6 | 27.3 | 35.7 | 184.9 | 99.6 | 6.3 |
| LC3 | 984 | 6.5 | 31.6 | 65.7 | 15.9 | 18.3 | 33.1 | 337.6 | 100.0 | 1.3 |
| ***Poorman Creek*** | | | | | | | | | | |
| Po1 | 1000 | 3.0 | 33.3 | 56.9 | 27.5 | 15.6 | 10.2 | 163.6 | 100.0 | 0.9 |
| Po2 | 1000 | 6.0 | 42.5 | 66.3 | 4.2 | 27.9 | 24.5 | 105.6 | 100.0 | 1.3 |
| ***Ramsey Creek*** | | | | | | | | | | |
| Ra2 | 997 | 3.0 | 55.6 | 67.7 | 9.0 | 23.3 | 20.4 | 116.3 | 99.3 | 2.1 |
| Ra3 | 1000 | 9.0 | 52.5 | 42.1 | 3.2 | 17.9 | 18.3 | 131.9 | 100.0 | 0.0 |
| Ra4 | 1000 | 2.5 | 52.9 | 49.8 | 39.8 | 10.4 | 6.1 | 205.8 | 100.0 | 0.0 |

LWD = large woody debris.
Source: Watershed Consulting and Kline Environmental Research 2005.

**Table 55. Stream Geomorphology Data for Libby Creek and Tributaries.**

| Site and Year Sampled | Rosgen Type | BFW (ft) | Pools/ft | LWD/ft | Percent Bank Stability | Width/ Depth Ratio |
|---|---|---|---|---|---|---|
| 7 Libby 2005 | D4 | 322 | 1/1,110 | 1/347 | 68 | 120 |
| 8 Libby 2005 | F3 | 55 | 1/1,222 | 1/203 | 100 | 47.8 |
| 9 Libby 2005 | B3c | 39 | 1/797 | 1/80 | 100 | 34.7 |
| 10 Libby 1997 | B3c | 49.7 | 1/180 | 1/25 | 100 | 22.7 |
| 10 Libby 2004 | F3 | 37.4 | 1/279 | 1/70 | 79 | 35.1 |
| 11 Libby 1997 | B3c | 44.9 | 1/225 | 1/450 | 100 | 32.9 |
| 11.5 Libby 2004 | B2a | 33.3 | 1/223 | 1/335 | 77 | 76.6 |
| 12 Libby 1997 | C4 | 36.7 | 1/249 | 1/23 | 95 | 19.4 |
| 12 Libby 2004 | C3 | 27.8 | 1/5 | 1/50 | 100 | 57 |
| 13 Libby 1997 | C3 | 27.9 | 1/141 | 1/37 | 96.5 | 19.7 |
| 13 Libby 2004 | F3 | 28.6 | 1/192 | 1/36 | 100 | 43.4 |
| 14 Libby 1997 | B3c | 35.8 | 1/144 | 1/23 | 91 | 24.5 |
| 15 Libby 1997 | F3b | 23.4 | 1/165 | 1/247 | 100 | 16.6 |
| 15 Libby 2004 | B3 | 23.8 | 1/127 | 1/85 | 100 | 28.2 |
| 16 Libby 1997 | B3c | 34.8 | 1/357 | 1/48 | 100 | 26 |
| 16 Libby 2004 | F4b | 24.3 | 1/173 | 1/11 | 100 | 38.3 |
| 17 Libby 1997 | C3b | 31.9 | 1/192 | 1/36 | 100 | 43.4 |
| 17 Libby 2004 | B3c | 22.2 | 1/117 | 1/6 | 100 | 110.4 |
| 1 Little Cherry 1997 | F4b | 11 | 1/37 | 1/16 | 91 | 19.8 |
| 1 Midas 1998 | B4 | 12.6 | 1/50 | 1/10 | 100 | 14.2 |
| 2 Midas 1998 | F4b | 11.8 | 1/34 | 1/19 | 100 | 18.8 |
| 3 Midas 1998 | F3b | 7.8 | 1/31 | 1/16 | 100 | 17 |
| 4 Midas 1998 | B4 | 7.8 | 1/21 | 1/15 | 100 | 12.2 |
| 1 Poorman 1997 | B2a | 16 | 1/40 | 1/108 | 100 | 18.1 |
| 2 Poorman 1997 | F3b | 23.7 | 1/13 | 1/13 | 100 | 15.3 |
| 2 Ramsey 1997 | B2c | 15.2 | 1/31 | 1/22 | 100 | 18.1 |
| 1 Ramsey 1998 | B3 | 22.5 | 1/7 | 1/16 | 100 | 17.5 |
| 1 Bear 2004 | B3c | 19.6 | 1/100 | 1/19 | 100 | 22.37 |
| 4 Bear2002 | G4 | 16.82 | 1/121 | 1/18 | 100 | 1.14 |
| 2 Bear 2003 | F3b | 24.7 | 1/620 | 1/44 | 17 | 44.1 |
| 1 Bear 1997 | B3c | 25.2 | 1/127 | 1/63 | 100 | 24.9 |
| 1 Bear 2003 | B3c | 25.2 | 1/127 | 1/63 | 100 | 24.9 |
| 3 Bear 1997 | F3 | 33.4 | 1/134 | 1/37 | 100 | 1.41 |
| 2 Bear 1997 | B3c | 32.8 | 1/111 | 1/21 | 100 | 31.4 |
| 3 Bear 2004 | F3 | 26.8 | 1/50 | 1/35 | 100 | 15.5 |

Shaded values indicate RMOs or goals not met.
LWD = large woody debris; BFW = bankfull width.
Source: Libby Ranger District files 2007.

Three habitat indices also were calculated as part of the 1988-1989 habitat evaluations (Western Resource Development Corp. 1989a). The riparian habitat condition index is calculated based on nine vegetation and substrate measures, with the overall value ranging from 0 to 36. All values above 30 indicate excellent riparian habitat in the analysis area, with values between 22 and 30 indicating good riparian habitat. Based on this index, riparian habitat was good or excellent throughout most stream reaches (Table 56).

The habitat vulnerability index rates sites for potential susceptibility to aquatic habitat degradation based on measures of valley bottom width, stream gradient, upper bank slope, lower bank slope, bank stability, and indications of sediment production. Scores greater than 60 indicate high vulnerability to degradation. Scores between 45 and 60 indicate moderate vulnerability to degradation. Scores less than 45 indicate low vulnerability to degradation. Most streams in the analysis area had a moderate vulnerability (Table 56).

The habitat condition index measures potential fishery habitat. It ranges from 0 to 100, with higher scores indicating higher quality of habitat. Overall, the analysis area scored high on measures such as bank cover and stability, while measures of pool quality and quantity were typically lower, resulting in an overall reduction in stream reach scores (Table 56).

As an additional part of the baseline habitat surveys conducted in 1988 and 1989 (Western Resource Development Corp. 1989a), the percentage of potential spawning and rearing areas for fish was estimated for each reach of East Fork Rock Creek and the streams within the Libby Creek watershed.

The composition of spawning gravel was sampled with a McNeil core sampler from 15 stream reaches in Libby Creek, Little Cherry Creek, Ramsey Creek, Poorman Creek, and Bear Creek in 2005 (Table 57; Kline Environmental Research and Watershed Consulting 2005b; Wegner, pers. comm. 2006a). Additionally, a single site was surveyed on Rock Creek and three sites on the East Fork Bull River between 1992 and 1994 using similar sampling methods (Washington Water Power Company 1996). Samples were collected from sites that appeared most suitable for spawning. In the laboratory, samples were dried and sieved. Imhoff cones were used in the field to estimate fine sediment not accounted for in the McNeil core samples. This aspect of the stream habitat is important as the proportion of fine sediment in spawning gravel can be a limiting factor to the reproductive success of bull trout and other salmonids that deposit eggs in the stream gravel.

Generally, core samples showed that the upstream sites had a higher percentage of fine sediment and a smaller median substrate size in comparison to the downstream sites (Table 57). The most downstream reach on Libby Creek had the lowest percent fine sediment (14.6 percent), while the site sampled on Rock Creek (RC2) had the highest percent fine sediment (43.0 percent) (Kline Environmental Research and Watershed Consulting 2005b).

### Libby Creek

The riparian habitat condition index, rated as fair throughout the reach of Libby Creek downstream of the Poorman Creek confluence (Site L4), reflects the physical effects of abandoned placer mining operations. All other reaches were rated excellent or good. The mean habitat vulnerability index was rated moderate for all sites.

**Table 56. Mean Habitat Values for Analysis Streams in 1988-1989.**

| Site | Mean Riparian Habitat Condition Index | Mean Habitat Vulnerability Index | Mean Habitat Condition Index | Potential Spawning Area (%) | Potential Rearing Area (%) |
|---|---|---|---|---|---|
| ***Libby Creek*** | | | | | |
| L1 | 33/Excellent | 55.45/Moderate | 74.1 | 44.6 | 7.7 |
| L2 | 33/Excellent | 55.61/Moderate | 75.5 | 25.0 | 16.8 |
| L4 | 18/Fair | 48.79/Moderate | 55.4 | 34.2 | 21.7 |
| L5 | 29/Good | 43.94/Moderate | 66.8 | 26.2 | 18.2 |
| L8 | 25/Good | 44.70/Moderate | 70.1 | 36.6 | 39.2 |
| L10 | 33/Excellent | 52.73/Moderate | 70.6 | 26.7 | 20.6 |
| L11 | 32/Excellent | 55.91/Moderate | 80.0 | 33.8 | 28.6 |
| ***Bear Creek*** | | | | | |
| Be1 | 29/Good | 44.55/Moderate | 73.2 | 29.1 | 25.1 |
| Be2 | 31/Excellent | 57.73/Moderate | 78.6 | 37.6 | 31.6 |
| Be3 | 30/Excellent | 61.97/High | 77.7 | 22.7 | 28.4 |
| ***Little Cherry Creek*** | | | | | |
| LC1 | 33/Excellent | 52.88/Moderate | 65.9 | 25.2 | 17.8 |
| ***Poorman Creek*** | | | | | |
| Po0 | 32/Excellent | 45.76/Moderate | 60.4 | 35.2 | 8.0 |
| ***Ramsey Creek*** | | | | | |
| Ra2a | 31/Excellent | 58.94/Moderate | 72 | 29.1 | 13.3 |
| Ra3 | 32/Excellent | 58.03/Moderate | 65.4 | 18.6 | 21.9 |
| Ra4 | 31/Excellent | 60.45/High | 50.9 | 4.4 | 99.0 |
| ***East Fork Rock Creek*** | | | | | |
| Ro1 | 33/Excellent | 59.24/Moderate | 75.4 | 5.7 | 34.2 |
| Ro3 | 29/Good | 63.03/High | 60.6 | 3.6 | 91.1 |
| Ro4 | 30/Excellent | 53.18/Moderate | 61.1 | 2.3 | 34.4 |

Source: Western Resource Development Corp. 1989a.

**Table 57. Mean Particle Size Distribution of McNeil Core Samples for Sites within the Analysis Area.**

| Site | Mean Particle Size (mm) | Mean % fine sediment (<6.25 mm) |
|---|---|---|
| | ***Libby Creek*** | |
| L1 | 37.6 | 14.6 |
| L2 | 26.6 | 19.6 |
| L3 | 24.2 | 25.0 |
| L9† | 19.0 | 29.0 |
| L10 | 25.8 | 21.7 |
| L11 | 23.9 | 19.7 |
| | ***Little Cherry Creek*** | |
| LC1 | 24.5 | 19.5 |
| LC2 | 18.5 | 23.9 |
| LC3 | 35.3 | 39.4 |
| | ***Poorman Creek*** | |
| Po1 | 28.0 | 17.2 |
| Po2 | 22.8 | 21.0 |
| | ***Ramsey Creek*** | |
| Ra2 | 33.4 | 14.8 |
| Ra3 | 23.6 | 22.2 |
| Ra4 | 23.0 | 23.1 |
| | ***Bear Creek*** | |
| Be2† | 25.0 | 23.0 |
| | ***Rock Creek*** | |
| Ro1 | Not Calculated | 43.0 |
| | ***East Fork Bull River*** | |
| EFBR1 | Not Calculated | 25.0 |
| EFBR2 | Not Calculated | 33.0 |
| EFBR3 | Not Calculated | 15.0 |

†Sites were surveyed in 2005 by Libby Ranger District; data from other years also available.
mm = millimeter.
Source: Kline Environmental Research and Watershed Consulting 2005b.

The most likely locations for spawning in Libby Creek included the reaches downstream from its confluence with Bear Creek (Site L1), near its confluence with Poorman Creek (Site L4), downstream from Ramsey Creek (Site L5), and downstream from Howard Creek (Site L8).

Potential spawning habitat ranged from 25 to 45 percent of the total length of each surveyed reach in Libby Creek, and potential rearing areas ranged from 8 to 39 percent (Table 56).

In 2001, sections of Libby Creek were restored by the FWP. This project was implemented because accelerated bank erosion along some meander bends had resulted in a widened, shallow, and unstable stream channel that produced low quality habitat for native trout (Dunnigan *et al.* 2004). A part of the restoration focused on 1,700 feet of the stream located above the confluence of Elliot Creek with Libby Creek. Two eroding banks in this area were contributing substantial amounts of sediment to Libby Creek. The project restored this reach of Libby Creek, reduced bank erosion, and increased the quantity and quality of rearing habitat for native salmonids (Dunnigan *et al.* 2005). A second restoration project, designated the upper Cleveland restoration project, focused on about 3,200 feet of Libby Creek between the confluences of Howard Creek and Ramsey Creek. The restoration effort was aimed at increasing sinuosity (and thereby stream length) and the number of pools within the stream channel. The project additionally added cobble structures, rootwad complexes, and rock vanes to increase gradient control, pool habitat, and bank protection. Various shrubs, willows, and cottonwoods were planted to establish a healthy riparian area (Dunnigan *et al.* 2004). Much of this habitat restoration work was destroyed or damaged during a spring 2007 rain-on-snow effect, so current habitat conditions may not reflect these improvements. Rain-on-snow events occur with sufficient frequency to make habitat improvements in Libby Creek difficult to maintain.

Overall, the Libby Creek stream reaches were dominated by riffle habitat, with stable banks and good cover for fish (Table 54). All reaches were moderate in gradient (≤ 4 percent), except the most upstream reach. The dominant substrate types at all reaches were gravel and cobble (Watershed Consulting and Kline Environmental Research 2005).

### Bear Creek

The mean riparian habitat condition index for Bear Creek was good in the upper reach and excellent in the two lower reaches. Based on the mean scores for each reach, the upper reach of Bear Creek was rated as having a potentially high vulnerability to degradation (Table 56). Other reaches of Bear Creek were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a).

Probable spawning areas include reaches in Bear Creek both downstream and upstream of Bear Creek Road (NFS road #278). Potential spawning habitat ranged from 23 to 38 percent in the surveyed reaches of Bear Creek, and potential rearing areas ranged from 25 to 32 percent (Table 56).

Bear Creek was also dominated by riffle habitat, had stable banks and the gradient at Site Be2 was 2.0 percent (Table 54). The dominant substrate types were cobble and gravel. The single reach surveyed on Bear Creek was noted as having good over-wintering and juvenile salmonid rearing habitat, although it appeared to provide limited spawning habitat.

### Little Cherry Creek

The riparian habitat condition index for Little Cherry Creek was rated as excellent. The habitat vulnerability index was rated as moderate (Table 56). Potential spawning habitat was 25 percent in the surveyed reach of Little Cherry Creek, and potential rearing area was 18 percent (Table 56).

The stream reaches surveyed in the Little Cherry Creek were dominated by riffle habitat and had stable banks. Gradient was moderate to fairly steep (Table 54). The dominant substrate types at all reaches were cobble and gravel.

The upstream Little Cherry Creek site provided limited winter habitat availability and poor pool habitat. Although a few larger pools did exist in the middle reach of Little Cherry Creek, overall this reach also provided poor pool habitat, and little fish cover. The most downstream Little Cherry Creek reach had high habitat diversity, but low base flow water volumes.

#### Poorman Creek

The riparian habitat condition index for Poorman Creek was rated as excellent. The habitat vulnerability index was rated as moderate. Potential spawning area was found in the reach of Poorman Creek above its confluence with Libby Creek. Potential spawning habitat was 35 percent in the surveyed reach of Poorman Creek, and potential rearing area was 8 percent (Table 56).

The stream reaches surveyed in Poorman Creek were dominated by riffle habitat and had stable banks. Gradient was 3 percent in the upper reach and 6 percent in the lower reach (Table 54). The dominant substrate types at all reaches were cobble and gravel.

The downstream reach on Poorman Creek was braided, with much of the side channel water going subsurface before re-entering the main channel. The upstream Poorman Creek reach had high quality pocket pool habitat formed by cobble and small boulders that serve as good interstitial habitat for juvenile bull trout.

#### Ramsey Creek

The riparian habitat condition index was rated as excellent for all reaches of Ramsey Creek. Based on the mean scores for each reach, the upper reach of Ramsey Creek was rated as having a potentially high vulnerability to degradation (Table 56). The other reaches were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a).

Potential spawning habitat ranged from 4 to 29 percent in the surveyed reaches of Ramsey Creek, and potential rearing areas ranged from 13 to 99 percent (Table 56).

The stream reaches surveyed in Ramsey Creek were dominated by riffle habitat and had stable banks. Gradient ranged from 2.5 to 9 percent (Table 54). The dominant substrate types at all reaches were cobble and gravel.

The two downstream reaches on Ramsey Creek had a high amount of pool habitat. The farthest downstream Ramsey Creek reach had the highest amount of fish cover in Ramsey Creek, with larger pools that could offer winter fish habitat and a moderate amount of spawning gravel. The upstream Ramsey Creek reach had the lowest percentage of pool habitat out of all of the project stream reaches (Watershed Consulting and Kline Environmental Research 2005).

#### East Fork Rock Creek

The riparian habitat condition index was rated as good in the middle reach and excellent in the upstream and downstream reaches. The middle reach of East Fork Rock Creek was rated as having a potentially high vulnerability to degradation (Table 56). The other reaches were rated as

having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a).

Fish habitat was surveyed in four reaches of Rock Creek between 1992 and 1994 as part of a survey of the tributaries of the lower Clark Fork River (Washington Water Power Company 1996). The upstream reach was in East Fork Rock Creek, and was similar in location to the sites surveyed during the previous baseline surveys conducted there. Rock Creek was described as consisting of mainly run, low gradient riffle, and cascade habitat types, with substrate that was predominately rubble, cobble, gravel, and boulder. Other than the low gradient section termed Rock Creek Meadows, the reach on East Fork Rock Creek was composed primarily of cascade habitat, with a higher percentage of larger substrate such as boulder and cobbles present. Surface fines averaged 10 percent, and ranged from less than 1 to 22 percent. Generally the downstream reaches on Rock Creek contained lower amounts of large woody debris than the upstream reaches. Stream banks were relatively stable throughout Rock Creek, with some channel braiding. Substantial portions of the two downstream reaches have seasonally intermittent flows (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001).

Potential spawning habitat ranged from 2 to 6 percent in the surveyed reaches of East Fork Rock Creek, and potential rearing areas ranged from 34 to 91 percent (Table 56). While each reach was not evaluated, the potential spawning and rearing areas for the stream as a whole also were estimated for Rock Creek in 1992 to 1994 (Washington Water Power Company 1996). The percentage of potential spawning habitat in Rock Creek was 1.1 percent. The percentage of potential rearing habitat in this stream was 16.1 percent. When compared to other tributaries to the lower Clark Fork River, the percentage of potential spawning area was relatively low, while the percentage of rearing habitat in Rock Creek was similar to other streams.

### East Fork Bull River

As part of the fish habitat survey between 1992 and 1994 (Washington Water Power Company 1996), three reaches of the East Fork Bull River were surveyed. The habitat in this stream consists primarily of high gradient riffle and pool habitat types, with mainly cobble and rubble substrate in the high gradient sections and sand and silt in low gradient sections. East Fork Bull River had lower amounts of fine sediment than most of the other lower Clark Fork River tributaries, ranging from 7 to 11 percent surface fines. It had moderately high amounts of large woody debris (Washington Water and Power Company 1996). A project completed in 2001 restored about 1,000 feet of the channel in the lower East Fork Bull River with subsequent work done to reduce sediment and increase fish habitat (Avista Corp. 2007).

While each reach was not evaluated, the potential spawning and rearing areas for the stream as a whole also were estimated for the East Fork Bull River in 1992-1994 (Washington Water Power Company 1996). The percentage of potential spawning habitat in the East Fork Bull River was 0.6 percent. The percentage of potential rearing habitat in this stream was 4.1 percent. When compared to other tributaries to the lower Clark Fork River, these percentages were relatively low.

### Fisher River and Miller Creek

The stream reaches surveyed in the Fisher River had gradients that were generally less than 1.0 percent. Miller Creek was sampled in 1998 and 2005, and comparisons between years are shown in Table 58. Overall, gradients were moderate to steep, and mean substrate size ranged from gravel to cobble sizes.

**Table 58. Stream Geomorphology Data for West Fisher and Miller Creeks and Tributaries.**

| Site and Year | Rosgen Type | BFW (ft) | Pools/ ft | LWD/ft | Percent Bank Stability | Width/ Depth Ratio |
|---|---|---|---|---|---|---|
| 1 West Fisher 1996 | D4 | 98 | 1/673 | 1/1009 | 100 | 109 |
| 3 West Fisher 1996 | B3c | 18.3 | 1/324 | 1/93 | 24 | 32.9 |
| 5 West Fisher 1996 | C4 | 19.1 | 1/96 | 1/77 | 89 | 25 |
| 8 West Fisher 1996 | B3a | 15.2 | 1/53 | 1/45 | 100 | 17.8 |
| 1 Miller Creek 1998 | B3c | 12.1 | | 1/9.6 | 100 | 15.78 |
| 1 Miller Creek 2005 | B4 | 16.4 | dry | 1/10 | 95 | 11.47 |
| 2 Miller Creek 1998 | B4c | 10.8 | 1/34 | 1/80 | 100 | 14.8 |
| 2 Miller Creek 2005 | F4 | 10.9 | 1/54 | 1/18 | 100 | 29.02 |
| 3 Miller Creek 1998 | F4 | 11.2 | 1/120 | 1/243 | 93 | 13.3 |
| 3 Miller Creek 2005 | E4 | 13.2 | 1/270 | 1/45 | 86 | 10.19 |
| 4 Miller Creek 1998 | B4c | 13 | 1/54 | 1/39 | 97 | 16.6 |
| 4 Miller Creek 2005 | B4c | 11.3 | 1/139 | 1/132 | 100 | 12.99 |
| 5 Miller Creek 1998 | B3c | 9.2 | 1/185 | 1/16.2 | 100 | 16.17 |
| 5 Miller Creek 2005 | B4a | 9 | 1/47 | 1/37.6 | 100 | 13.64 |
| 6 Miller Creek Trib. 1998 | Da4 | 4.3 | Dry | nc | nc | 21.5 |
| 6 Miller Creek Trib. 2005 | Da4 | 3.8 | Dry | 1/5 | 100 | 9.87 |
| 7 Miller Creek Trib. 1998 | B4 | 6.9 | 1/46 | 1/6 | 80 | 9.1 |
| 7 Miller Creek Trib. 2005 | B4 | 6.1 | Dry | 1/8.5 | 100 | 22.59 |
| 8 Miller Creek 1998 | B4c | 9.8 | 1/66 | 1/28 | 87 | 13.24 |
| 8 Miller Creek 2005 | F4b | 11.5 | 1/5 | 1/18 | 100 | 25.68 |
| 9 South Fork Miller 1998 | B4 | 6.7 | 1/33 | 1/8.7 | 80 | 17.96 |
| 9 South Fork Miller 2005 | E4b | 7 | 1/36 | 1/72 | 100 | 4.86 |
| 10 South Fork Miller 1998 | C4b | 5.2 | 1/32 | 1/8 | 32 | 20.08 |
| 10 South Fork Miller 2005 | E4b | 6 | 1/3.7 | 1/6.2 | 100 | 5.77 |
| 11 Miller Creek 1998 | F4b | 9.7 | 1/70 | 1/15 | 82 | 21.04 |
| 11 Miller Creek 2005 | B4 | 8.4 | 1/46 | 1/11 | 100 | 20.48 |
| 12 North Fork Miller 1998 | F3b | 10 | 1/40 | 1/9 | 24 | 31.05 |
| 12 North Fork Miller 2005 | F4b+ | 8.84 | dry | 1/10 | 50 | 32.81 |
| 13 Miller Creek 1998 | F4b | 6.8 | 1/64 | 1/128 | 83 | 28.33 |
| 13 Miller Creek 2005 | F4 | 5.8 | 1/39 | 1/8 | 100 | 17.44 |
| 14 Miller Creek 1998 | G4 | 4.7 | 1/24 | 1/7 | 100 | 9.79 |
| 14 Miller Creek 2005 | G4 | 5.7 | 1/28 | 1/5 | 100 | 15.8 |
| 15 Miller Creek 1998 | B4a | 5.5 | 1/28 | 1/6 | 99.94 | 13.41 |
| 15 Mainstem 2005 | F4B | 3.0 | 1/10 | 0/60 | 100 | 16.6 |

Shaded values indicate RMOs or goals not met.
BFW = bank full width; LWD = large woody debris.
Source: Libby Ranger District files 2007.

### *3.6.3.1.2 Barriers to Fish Passage*

Over the years, as part of the road system on the KNF, culverts have been installed on streams, some of which have created migration barriers to fish. Barriers have been created on tributaries to the main stems of Libby and West Fisher creeks. The KNF replaced one such barrier in 2007 on Midas Creek where the Libby Creek Road (NFS road #231) crosses the stream. Existing barriers that inhibit fish use of Libby Creek or its tributaries include: a large natural waterfall on Libby Creek; a thermal barrier in the lower several miles of the mainstem of Libby Creek near the

mouth with the Kootenai River that occurs seasonally in some years; loss of flow in various reaches (in Libby Creek near the U.S. 2 bridge and the lower segment of the stream near the mouth with the Kootenai River); and double pipe culverts on NFS road #14458 on upper Midas Creek. No permanent known man-made barriers are on the mainstem of Libby Creek. The Vaughn and Greenwall ditch, which was constructed in 1900 to provide a water source for mining activities, possibly provided a passage around the falls in Libby Creek. This ditch is no longer functional and upstream movement is no longer available. Bull trout above the falls are currently isolated from the remainder of the population although downstream movement likely occurs.

In September 2005, a search for barriers to fish passage in the analysis area was conducted (Kline Environmental Research 2005b); a survey to determine the fish passage status of culverts existing in the watershed was conducted in July and August 2005 (Kline *et al.* 2005). The only barrier on Libby Creek documented in these reports was the 39-foot waterfall (Libby Creek Falls) located about 6,200 feet upstream of the Howard Creek confluence. The portion of Libby Creek downstream of NFS road #231 and Libby Creek Falls was not searched for barriers due to FWP's restoration efforts within that reach. No culverts exist on Libby Creek within the analysis area.

Permanent barriers to fish passage were found on Ramsey Creek, Little Cherry Creek, and Poorman Creek that appear to cause portions of these tributaries to be inaccessible to fish from Libby Creek. Little Cherry Creek provides the least amount of habitat for fish from Libby Creek, as a subsurface reach exists during low flow conditions immediately at its confluence with Libby Creek. Even during higher flow conditions, about 950 feet or less of the stream is accessible to fish from Libby Creek due to a series of barriers, the most upstream of which was judged to be impassable to all fish (although small populations of redband trout have been found upstream of those barriers, as discussed below). Additionally, two culverts exist on Little Cherry Creek at the crossing of NFS roads #6212 and #278, upstream of the natural barriers. Poorman Creek has a subsurface reach near its confluence with Libby Creek, but during adequate flow conditions about 2.5 miles of lower Poorman Creek are accessible before a barrier impassable to all fish is encountered. Downstream of this barrier at the crossing of NFS road #278, a culvert that acts as a secondary barrier to juvenile trout at all flows and to adult trout at high flows also exists. Ramsey Creek is accessible to Libby Creek for about 2.7 miles before a barrier to most fish occurs, followed by a barrier to all fish about 1.5 miles upstream of that barrier. No culverts exist on Ramsey Creek (Kline Environmental Research 2005a; Kline Environmental Research *et al.* 2005).

A natural fish barrier is present immediately downstream of Rock Creek Meadows and at the outlet of Rock Lake, on Rock Creek, but these barriers do not prevent downstream fish passage. About 28 percent of Rock Creek is intermittent (GEI 2005), which may act as a barrier to migrating bull trout seasonally. A barrier is present about 1 mile upstream of the CMW boundary on the East Fork Bull River (USDA Forest Service and DEQ 2001; Washington Water Power Company 1996). The barriers were not assessed to determine if they are barriers to all fish or if they are navigable to some fish under some flow conditions.

The mainstem of West Fisher Creek has no known permanent natural or man-made barriers. A partial barrier exists at the confluence of West Fisher Creek and the Fisher River. This barrier occurs because of the high amount of bedload that is transported down West Fisher Creek. In low-water years, the stream has multiple shallow channels through which large migratory fish cannot pass. Miller Creek in the lower reaches near the confluence with the Fisher River is dry most of the year. Streamflow goes subsurface for nearly 0.5 mile in the drainage for most of the year. The

stream connects with the Fisher River only during spring high flows, or during rain or snow events.

### 3.6.3.2 Water Quality Characteristics

Overall surface water quality in streams and lakes within the analysis area is of excellent quality. Total suspended solids, total dissolved solids, major ions, and nutrient concentrations are very low in analysis area streams, and are frequently at or below detection limits. The low concentrations of nutrients and minerals within the analysis area severely limit the productivity potential for aquatic life. Metal concentrations are also generally low, with many metals below detection limits. Iron, copper, and silver are found in low concentrations above detection limits in most analysis area streams, perhaps reflecting the mineralized rock in the area. Rock Lake also has excellent water quality. Limited water quality data available for St. Paul Lake suggest it is somewhat less pristine than Rock Lake, but does not have constituents that inhibit aquatic life.

Because of very low alkalinities, analysis area streams are poorly buffered. Consequently, surface waters tend to be slightly acidic, with most pH values slightly below 7.0. This acidity has two likely natural sources – organic acids originating from surrounding coniferous forests and dissolved carbon dioxide ($CO_2$) in surface and ground water draining into the area streams. Median water hardness in all sampled streams within the Libby Creek drainage was less than 30 mg/L as calcium carbonate ($CaCO_3$), with several sampling locations with median hardness values under 10 mg/L $CaCO_3$ (Table 96 and Table 97). Water quality for the streams and lakes in the analysis area are discussed in section 3.12, *Surface Water Quality*.

### 3.6.3.3 Aquatic Plants and Periphyton

The results of the initial baseline monitoring conducted in 1988 and 1989 show that sparse growths of green algae (Chlorophyta), blue-green algae (Cyanophyta), and diatoms (Bacillariophyta) occur throughout the Libby Creek watershed within the analysis area. In general, the algal taxa found were typical of unpolluted, softwater streams in Montana. The low population densities are common in high-elevation streams and reflect the low nutrient content in the Libby Creek drainage waters. Of the green and blue-green algae taxa found within the analysis area, *Zygnema* and *Oscillatoria* were the most abundant and widespread genera (Western Resource Development Corp. 1989a).

Diatoms were present in all periphyton samples, but were collected at relatively low abundances at most reaches (Western Resource Development Corp. 1989a). Taxa richness also was low in these samples, ranging from 5 taxa to 27 taxa collected over the three sampling events in 1988 and 1989. The most abundant diatom taxon at most stations on most sampling dates was *Achnanthes minutissima* (Western Resource Development Corp. 1989a), which is often the first species to establish itself at a site disturbed by physical abrasion, and is common in mountain streams (Teply and Bahls 2005). When present in the samples, *A. minutissima* composed from 3 to 99 percent of the diatom community in these stream reaches. Relative abundances up to 25 percent of the diatom population indicate a normal level of disturbance, while relative abundances from 25 to 50 percent indicate minor disturbance and relative abundances greater than 50 percent indicate moderate to high levels of disturbance (Teply and Bahls 2005).

Periphyton sampling continued from 1991 through 1994. Analysis of the samples collected in 1991 and 1992 from Little Cherry Creek showed a relatively high diversity of algae taxa, possibly as a result of nutrient enrichment. Poorman and Ramsey creeks had a more limited algal diversity,

signifying low nutrient concentrations (Western Technology and Engineering, Inc. 1992, 1993). Periphyton samples were only collected from Libby Creek sites from 1993 to 1994. Based on diatom association indices (Western Technology Engineering, Inc. 1994, 1995), biological integrity upstream and at the nearest station downstream of the mining activities was good to excellent, and aquatic life was not impaired. The periphyton community did show some effects attributed to the elevated nitrogen levels in October 1991 at the site immediately downstream of the Libby Adit. Periphyton communities at this site were strongly dominated by *Ulothrix*, a green algae species that responds favorably to elevated nutrient levels. This site also had the highest diatom species richness and diversity values for that year. Biological integrity ratings were not adversely affected in latter years (Western Technology Engineering, Inc. 1994, 1995) as the periphyton community was not as strongly dominated by one green algae species in later sampling.

Periphyton samples were collected from nine sites in Rock Creek in 1985, with species composition described as typical of clean, soft waters in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). Periphyton accumulation was also monitored in Rock Creek and the East Fork Bull River in 1993 (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001). When compared to other tributaries in the lower Clark Fork River, net productivity and chlorophyll content was relatively high in Rock Creek, while the chlorophyll content of the samples was relatively low in the East Fork Bull River.

Aquatic plants and mosses also were documented during the initial baseline periphyton surveys. Aquatic macrophytes occurred only incidentally within the analysis area, and included sparse numbers of water buttercup (*Ranunculus*) in spring seeps in the Libby Creek floodplain and in Rock Creek Meadows, as well as sedges (*Carex*) in Rock Creek meadows. Byrophytes (mosses) were the predominant vegetation found along many stream reaches. They were particularly abundant in the upstream portions of each stream, but were present wherever stable substrates and dense forest canopies occur. They occurred only sporadically in Libby Creek's middle reaches, if at all (Western Resource Development Corp. 1989a).

#### 3.6.3.4 Aquatic Insects

Stream macroinvertebrates were collected from 21 locations in analysis area streams between 1986 and 2004 (Western Resource Development Corp. 1989a; USDA Forest Service and DEQ 2001; Western Technology and Engineering 1991, 1992, 1993, and 1994; Western Technology and Engineering and Phycologic 1995; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006). Data are summarized in Appendix F.

During the initial baseline study, mean macroinvertebrate densities and total taxa richness were highly variable (Appendix F). True flies (dipterans) were the most diverse group taxonomically, and had the highest relative abundance at some sites. Other insect groups with high diversity and relative abundances at all sites were mayflies (Ephemeroptera) and stoneflies (Plecoptera). Metal-intolerant macroinvertebrates, such as heptageniid mayflies, were consistently present at sites in each stream. Most of the macroinvertebrates collected are considered intolerant of fine sediments, heavy metals, and organic pollution (Western Resource Development Corp. 1989a).

Calculated indices characterizing macroinvertebrate communities during the initial baseline period indicated diverse macroinvertebrate communities and high water quality exist in analysis area streams. Differences in community characteristics among the stations were generally slight,

and were probably due to differences in stream order, microhabitat conditions, and variable sampling efficiencies.

Macroinvertebrate sampling continued from 1990 through 1994 at a limited number of sites. Both higher and lower values for most of the calculated metrics were observed during this period as compared to the baseline monitoring period data. No consistent spatial, temporal, or seasonal trends were apparent (Appendix F).

Macroinvertebrate data have also been collected from several reaches within analysis area streams as part of other projects. These studies included sampling reaches of East Fork Rock Creek from 1986 through 1988, and sampling reaches of Libby Creek, Bear Creek, West Fisher Creek, and the Fisher River from 1998 through 2004 (USDA Forest Service and DEQ 2001; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006). The data are presented in Appendix F.

More recent data for the analysis area are presented in Table 59. Taxa richness refers to the number of species collected at each site for each sampling event. Taxa richness has generally been high in recent sampling, with the exception of East Fork Rock Creek in 2005, Fisher River in 2002 and 2003, and Libby Creek Site L1 in 2002.

Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa can be used as an indicator of water quality, as they are considered sensitive to a wide range of pollutants (Plafkin *et al.* 1989; Wiederholm 1989; Klemm *et al.* 1990; Lenat and Penrose 1996; Wallace *et al.* 1996; Barbour *et al.* 1999; Lydy *et al.* 2000). The EPT index is a ratio of the number of EPT taxa collected compared to the number of total taxa collected. Values for these metrics typically increase with better water quality. The sensitive EPT taxa composed a substantial proportion of the macroinvertebrate community in all reaches sampled, making up 50 percent or more of the total number of taxa in all of the recent sampling events except for East Fork Rock Creek (Table 59). Values for the percent EPT abundance also were high during almost all sampling events, indicating that there are a diverse group of these sensitive taxa, and that they are found at high relative abundances.

Evenness ranges from 0 to 1, and is a measure of how well each species is represented within the invertebrate community. The Shannon-Weaver diversity index is recommended by the EPA as a measure of the effects of stress on invertebrate communities (Klemm *et al.* 1990). Shannon-Weaver index values greater than 2.50 are generally indicative of a healthy invertebrate community (Wilhm 1970). Most Shannon-Weaver diversity and evenness values indicated that healthy, well-balanced macroinvertebrate communities exist in the analysis area streams. Some low diversity values were recorded in East Fork Rock Creek, with values ranging from 0.69 to 1.53.

Of the metrics calculated, percent EPT is one of the most informative because it is less sensitive to differences in sampling and identification methods than most of the other metrics calculated. EPT reflects proportional abundances rather than actual numbers of invertebrates collected. A high abundance of EPT organisms indicates good water quality, as these taxa are generally intolerant of pollutants, low oxygen, high sediment loads, and high temperatures. Percent EPTs were generally high at most sites during most sampling events, and few trends between sites, years or seasons were identified.

**Table 59. Characteristics of Macroinvertebrate Populations during 2000-2005.**

| Stream | Sampling Site | Sampling Date | Taxa Richness | EPT Taxa Richness | EPT Index | Shannon-Weaver Diversity Index | Evenness | Data Source |
|---|---|---|---|---|---|---|---|---|
| Libby Creek Reach Immediately Upstream of Falls | L9 | Sep-00 | 24 | 16 | 67 | 2.26 | 0.5633 | USFS 2006 |
| | L9 | Aug-01 | 39 | 28 | 72 | 2.55 | 0.4860 | |
| | L9 | Aug-03 | 41 | 28 | 68 | 2.47 | 0.5340 | |
| | L9 | Jul-04 | 30 | 24 | 80 | 2.47 | 0.5910 | |
| Libby Creek Reach Near Midas Creek Confluence | L4 | Sep-00 | 33 | 25 | 76 | NC | NC | Dunnigan *et al.* 2004; Hoffman *et al.* 2002 |
| | L4 | Aug-03 | 35 | 28 | 80 | NC | NC | |
| Libby Creek Reach Near Bear Creek confluence | L3 | Jul-04 | 21 | 18 | 86 | 2.63 | 0.7720 | USFS 2006 |
| Libby Creek Reach Upstream of Crazyman Creek Confluence | L1 | Oct-00 | 29 | 22 | 76 | 2.25 | 0.5537 | USFS 2006 |
| | L1 | Aug-01 | 43 | 28 | 65 | 2.59 | 0.5370 | |
| | L1 | Aug-02 | 13 | 11 | 85 | 2.25 | 0.8820 | |
| | L1 | Aug-03 | 34 | 24 | 71 | 3.09 | 0.7850 | |
| | L1 | Jul-04 | 42 | 27 | 64 | 1.75 | 0.2790 | |
| Bear Creek | Be3 | Aug-00 | 32 | 24 | 75 | 2.75 | 0.6500 | USFS 2006 |
| | Be3 | Aug-01 | 33 | 23 | 70 | 2.66 | 0.5710 | |
| | Be3 | Aug-03 | 39 | 29 | 74 | 3.01 | 0.7150 | |
| | Be3 | Jul-04 | 28 | 22 | 79 | 2.54 | 0.6440 | |
| East Fork Rock Creek | SB-1 | Sep-05 | 9 | 4 | 44 | 1.53 | 0.4819 | Geomatrix 2006 |
| | SB-2 | Sep-05 | 7 | 2 | 29 | 1.08 | 0.3831 | |
| | SB-3 | Sep-05 | 11 | 4 | 36 | 0.69 | 0.1986 | |
| Fisher River at U.S. 2 | | Aug-01 | 34 | 19 | 56 | 2.62 | 0.5910 | USFS 2006 |
| | | Jul-02 | 10 | 7 | 70 | 2.02 | - | |
| | | Aug-03 | 16 | 9 | 56 | 2.10 | 0.5920 | |
| | | Jul-04 | 37 | 25 | 68 | 1.92 | 0.4530 | |
| West Fisher Creek | | Oct-00 | 28 | 17 | 61 | 2.26 | 0.5547 | USFS 2006 |
| | | Aug-01 | 39 | 26 | 67 | 2.83 | 0.5960 | |
| | | Jul-02 | 29 | 19 | 66 | 2.64 | 0.6210 | |
| | | Aug-03 | 39 | 23 | 59 | 2.79 | 0.6540 | |
| | | Jul-04 | 27 | 20 | 74 | 2.51 | 0.5970 | |

EPT = Ephemeroptera, Plecoptera, and Trichoptera.

These general findings indicate that the macroinvertebrate communities within the analysis area are variable temporally, spatially, and seasonally, and are likely influenced by factors other than water quality. The flow regime may be a major factor affecting macroinvertebrate abundances, with repeated high flow events resetting densities at low levels. The natural flow regime is dictated by drainage basin characteristics and precipitation events.

### 3.6.3.5 Fisheries

#### *3.6.3.5.1 Libby Creek Drainage Fish Populations*

**1988 Survey Results**

Electrofishing studies were conducted for the initial baseline study at 12 sites located on Libby Creek, Poorman Creek, Ramsey Creek, Little Cherry Creek, and East Fork Rock Creek in August and September 1988 (Figure 53 and Table 60). Native salmonid fish species collected within the Libby Creek drainage were redband trout and bull trout. While no effort was made to collect sculpins (*Cottus* sp.), they were noted as common at some sites. Both torrent sculpin and slimy sculpin inhabit the Libby Creek drainage. Torrent sculpin is a Montana Species of Concern. Redband trout was the dominant trout species in all analysis area streams in the Libby Creek watershed, ranging from 65 percent of the trout collected in Ramsey Creek, to 100 percent of the trout collected in Little Cherry Creek. Bull trout were collected from all analysis area streams except for Little Cherry Creek. Trout densities in all streams within the Libby Creek drainage were low (Table 60), with all streams except for Little Cherry Creek having no more than 8 trout per 100 square meters.

No trout were collected at the most upstream sites on Libby Creek (L11) or Ramsey Creek (Ra4). Site Ra4 was located above a barrier to all fish. Site L11 also may be located upstream of a barrier to fish passage, but barrier surveys did not extend that far upstream (Kline Environmental Research 2005b). Site L11 is the only site within the CMW in the Libby Creek drainage.

Using external characteristics to differentiate between pure interior redband trout and redband/rainbow, redband/cutthroat trout, and rainbow/cutthroat trout hybrids in the field is not reliable. Because no genetic analyses were performed at the time of this study, some uncertainty exists as to whether the redband trout collected during this study were pure redband trout or hybrids. Based on the results of genetic analyses conducted after the initial baseline study and described below, hybridization of redband trout with stocked rainbow trout and westslope cutthroat trout does occur in the analysis area streams.

Trout scales were analyzed for age and growth during the 1988 baseline survey. Most trout within the analysis area were young (age I, II, and III), as is typical for low productivity mountain headwater streams. Older (age IV) redband trout were found only in Ramsey Creek, while older bull trout (age IV or V) were found at sites on Ramsey and Libby creeks. Growth rates for all age classes were low, likely due to limitations caused by the low nutrient concentrations.

**Table 60. Redband, Bull, and Westslope Cutthroat Trout Population Characteristics in 1988 in Analysis Area Streams.**

| Site/ Stream | Redband Trout | | | Bull Trout | | | Westslope Cutthroat Trout | | |
|---|---|---|---|---|---|---|---|---|---|
| | Density (fish/100 $m^2$) | Average Length (cm) | Average Weight (grams) | Density (fish/100 $m^2$) | Average Length (cm) | Average Weight (grams) | Density (fish/100 $m^2$) | Average Length (cm) | Average Weight (grams) |
| ***Libby Creek*** | | | | | | | | | |
| L2 | 3 | 12.4 | 22.7 | <1 | 12.2 | 9.1 | 0 | — | — |
| L8b | 0 | — | — | 2 | 18.0 | 59.0 | 0 | — | — |
| L10 | 0 | — | — | 2 | 19.3 | 68.0 | 0 | — | — |
| L11 | 0 | — | — | 0 | — | — | 0 | — | — |
| ***Little Cherry Creek*** | | | | | | | | | |
| LC1 | 18 | 9.1 | 9.1 | 0 | — | — | 0 | — | — |
| LC2 | 16 | 9.7 | 13.6 | 0 | — | — | 0 | — | — |
| ***Poorman Creek*** | | | | | | | | | |
| Po0 | 8 | 11.9 | 22.7 | <1 | 16.8 | 49.9 | 0 | — | — |
| Po1a | 8 | 11.7 | 22.7 | 0 | — | — | 0 | — | — |
| ***Ramsey Creek*** | | | | | | | | | |
| Ra2a | 3 | 12.4 | 27.2 | 2 | 13.7 | 40.8 | 0 | — | — |
| Ra3 | 2 | 15.7 | 45.4 | 1 | 20.1 | 77.1 | 0 | — | — |
| Ra4 | 0 | — | — | 0 | — | — | 0 | — | — |
| ***Rock Creek*** | | | | | | | | | |
| East Fork Rock Creek | 0 | — | — | 4 | 16.0 | 40.8 | 10 | 14.2 | 36.3 |
| Rock Creek Meadows | 0 | — | — | 0 | — | — | ND† | 22.4 | 122.5 |
| Rock Lake | ND | ND | ND | ND | ND | ND | ND | ND | ND |

ND = Not determined. Methods used in Rock Creek Meadows did not allow for density determinations.

†Westslope cutthroat trout collected at Rock Creek Meadows site are thought to be hybridized with Yellowstone cutthroat trout and rainbow trout.

Source: Western Resource Development Corp. 1989a.

### Libby Creek Fish Populations and Genetics

Data from the MFISH database (FWP 2008a) and other sources were combined with data from the initial baseline survey to compose a list of all fish species that occur for each stream. Based on these data, the following fish species occur in the segment of Libby Creek within the analysis area: rainbow trout, interior redband trout, westslope cutthroat trout, bull trout, brook trout (*Salvelinus fontinalis*), slimy sculpin (*Cottus cognatus*), mountain whitefish (*Prosopium williamsoni*), longnose dace (*Rhinichthys cataractae*), largescale suckers (*Catostomus macrocheilus*), and various salmonid hybrids noted above. Results of the specific surveys documented in the either MFISH database (FWP 2008a), Kline Environmental Research (2004), or Dunnigan *et al.* (2004, 2005) only record rainbow trout (presumably referring to redband trout, rainbow trout, and their hybrids), brook trout, bull trout, and sculpin as having been collected from the segment of Libby Creek downstream of Libby Creek Falls, and only bull trout as having been collected from the segment of Libby Creek upstream of the falls.

Surveys conducted from 1988 through 2004 show variable trout densities between years and survey sites, ranging from no trout collected during surveys of some reaches to up to 12 to 117 trout/100 meters (m) within a reach (Kline Environmental Research 2004; Dunnigan *et al.* 2005). Redband trout and/or their hybrids were the dominant trout species at almost all sites downstream of the falls during years sampled. Bull trout were generally collected in low numbers in most reaches downstream of the falls. These data are consistent with the results of the initial baseline surveys. Brook trout were first collected in Libby Creek within the analysis area in 2004, but were collected more frequently from Libby Creek sites downstream of the analysis area in earlier years (Kline Environmental Research 2004; Dunnigan *et al.* 2005).

Genetic analyses were performed on rainbow trout tissues collected from sites in Libby Creek within the analysis area in 1991, 1992, 2000, and 2006. The analyses conducted in 1991 and 2000 from Libby Creek between the confluence of Howard Creek and Ramsey Creek (FWP 2008a) showed that all fish collected were rainbow trout. Clarification as to the sub-species of rainbow trout was not found for the 1991 analysis in the MFISH database. A memo from Robb Leary (2003) of the University of Montana to Mike Hensler of the FWP stated that the 2000 analyses were characteristic of a pure redband trout population. These results suggest that the 1991 analysis results likely also referred to redband trout. Non-native rainbow trout have been stocked in Howard Lake, potentially allowing these trout to access Libby Creek through Howard Creek.

Trout also were collected for genetic analysis in 1992 from a more downstream segment of Libby Creek between the confluences of Ramsey and Poorman creeks. These trout were shown to be redband trout/rainbow trout hybrids (52.3 percent redband, 45.7 percent rainbow). The trout collected for the 2006 genetic analyses were from a reach of Libby Creek upstream of the Little Cherry Creek confluence. Results indicated that these trout were rainbow trout/westslope cutthroat trout hybrids (98.9 percent rainbow, 1.1 percent westslope cutthroat trout), instead of the redband trout/rainbow trout hybrids that were collected farther upstream in 1992. The subspecies of rainbow trout was not specified in the 2006 analyses (FWP 2008a).

### Little Cherry Creek Fish Populations and Genetics

The Libby Creek tributaries have a lower diversity of fish species than the Libby Creek mainstem, with redband trout dominating other trout species in these streams. The MFISH database (2008a) lists interior redband trout, rainbow trout, bull trout, westslope cutthroat trout/rainbow trout hybrids, and redband/rainbow trout hybrids as occurring in Little Cherry

Creek. Field data for all surveys summarized in the MFISH database and by Kline Environmental Research (2004) document only the collection of "rainbow" trout, with no specific data pertaining to the collection of bull trout or any other species. Only one additional survey is documented in MFISH other than the results of the initial baseline study. This survey was conducted from a section of Little Cherry Creek about 1 mile upstream from its confluence with Libby Creek and documents 24 rainbow trout (presumably redbands or their hybrids) collected from an unknown length of the stream.

Genetic analyses were performed on trout collected in 1991, 1992, and 2005 from Little Cherry Creek. The earlier results of the genetic analysis conducted on the 25 trout collected in 1991 and the five trout collected in 1992 determined that these trout were redband/westslope cutthroat trout hybrids (1991 analysis) and redband/rainbow trout hybrids (1992 analysis) (Kline Environmental Research 2004; FWP 2008a). A recent genetic analysis conducted on 30 trout collected in 2005 from Little Cherry Creek determined that the trout population was composed of non-hybridized pure redband trout (Leary 2006). The 2005 results prompted the re-examination of the 1991 and 1992 results. Re-analysis of the 1991 results determined that what was initially taken to be a small amount of hybridization with westslope cutthroat trout was more likely to be redband trout genetic variation that was indistinguishable from that usually characteristic of westslope cutthroat trout due to the small sample size. The 1992 results also were determined to have erroneously reported that the trout population was hybridized with rainbow trout due to the limited genetic sampling that had occurred throughout the drainage. More recent genetic sampling in the area resulted in those analyses being re-interpreted so as to confirm the presence of a non-hybridized redband trout population in Little Cherry Creek (Leary 2006).

#### Poorman Creek Fish Populations and Genetics

Poorman Creek has been sampled four times between 1982 and 1994, with total trout densities at sites ranging from 5 trout/100 m to 36 trout/100 m (Kline Environmental Research 2004; FWP 2008a). Rainbow trout (no sub-species listed) and slimy sculpin are listed as occurring commonly in the creek, with bull trout occurring rarely (FWP 2008a). Genetic analyses were conducted on tissues from five trout in 1991 and 25 trout in 2000, and indicated that the trout population in Poorman Creek consists of pure rainbow trout, but does not specify the subspecies of rainbow trout (FWP 2008a). The memo from Robb Leary (2003) to Mike Hensler states that the allele frequencies detected during the genetic analyses are actually characteristic of redband trout, not rainbows. The memo also states that while the population should conservatively be considered non-hybridized, the possibility of the population being slightly hybridized with westslope cutthroat trout cannot be ruled out without further data.

#### Ramsey Creek Fish Populations and Genetics

Fish distribution surveys on Ramsey Creek were conducted during three years between 1976 and 1988, with bull trout and redband trout collected at total densities ranging from 4 to 26 trout/100 m (Kline Environmental Research 2004; FWP 2008a). Genetic analysis performed on six trout collected from Ramsey Creek in 1991 (FWP 2008a) indicated that the rainbow trout population was hybridized with westslope cutthroat trout (98.7 percent rainbow trout, 1.3 percent westslope cutthroat trout). Although the MFISH database does not specify the sub-species of rainbow trout indicated to have hybridized with westslope cutthroat trout, based on the historical distribution of redband trout throughout this area and the results of subsequent genetic analyses, these hybrids are likely redband trout hybridized with westslope cutthroat trout rather than rainbow trout hybrids. An additional 25 fish were analyzed in 2000. Analysis revealed that 24 of those trout

were pure redband trout, and one trout was a redband/westslope cutthroat hybrid. Based on the results of this analysis, the memo from Robb Leary to Mike Hensler (2003) stated that the population could be considered to be redband trout from a management perspective.

#### Bear Creek Fish Populations and Genetics

Bear Creek is north of the Little Cherry Creek Tailings Impoundment Site, and was not surveyed in 1988 as part of the initial baseline study. It was surveyed frequently after 1988. Based on the MFISH database, brook trout, bull trout, redband trout, rainbow trout, and westslope cutthroat trout have been observed in Bear Creek. During most sampling events in Bear Creek that occurred from 1982 through 1995, rainbow (presumably redband and redband hybrid) trout have been the dominant species, ranging from 38 to 100 percent of the trout observed. Westslope cutthroat trout (or their hybrids) were observed in the 1994 and 1995 sampling events, and a single brook trout was observed in 1994. Bull trout have been observed during almost every sampling event, both in the upstream and downstream portions of the creek, and have ranged from 3 to 62 percent of all fish collected. Since 1994, no more than 18 percent of the fish collected have been identified as bull trout. Additionally, while the number observed was not provided, bull trout continued to be documented as present in Bear Creek in recent sampling events from 1999 to 2004 (FWP 2008a).

Genetic testing has been conducted twice on trout tissues collected from Bear Creek. The results of the analysis of four trout in 1991 indicated that the trout population consisted of rainbow/cutthroat hybrids (98.7 percent rainbow, 1.3 percent cutthroat), but did not indicate whether "rainbow" referred to rainbow or redband trout genes. Based on the analyses conducted in 2000, the trout population in Bear Creek is composed of redband/westslope cutthroat hybrids, as 29 of the trout analyzed were redbands, with the remaining fish being a redband/cutthroat hybrid (FWP 2008a).

#### 2005 Survey Results

To assess where fish populations and species composition have remained relatively unchanged since the initial baseline study was conducted, day and night snorkeling surveys were conducted at 10 sites located on Little Cherry Creek, Libby Creek, Poorman Creek, and Ramsey Creek in July and August 2005. Overall, the distribution of fish within the analysis area was similar to those reported in previous surveys (Table 61). As already discussed, redband trout, rainbow trout, and their hybrids (redband/rainbow and redband/cutthroat hybrids) cannot always be visually distinguished based on external characteristics and were recorded only as *Oncorhynchus* sp. during these surveys. While the brook trout and bull trout surveyed had external characteristics consistent with one or the other species, hybrids between these two species also occur and could affect the results. Additionally, both torrent and slimy sculpin are found in analysis area streams and cannot be readily identified based on external morphology. Sculpin were not identified at the species level. Consistent with the 1988 results, the dominant fish species at all sites where fish were observed was *Oncorhynchus* sp. (Kline Environmental Research and Watershed Consulting 2005a).

**Table 61. Total Fish Counts per 1,000-foot Stream Reach During Day and Night Snorkeling Surveys.**

| Site | Time | Fish Species | | | | | | Young of Year Fish |
|---|---|---|---|---|---|---|---|---|
| | | *Oncorhynchus* sp. | Brook Trout | Bull Trout | Sculpin | Longnose Dace | Largescale Sucker | |
| ***Libby Creek*** | | | | | | | | |
| L1 | Day | 53 | 12 | 0 | 0 | 0 | 0 | 49 |
| | Night | 102 | 8 | 1 | 10 | 35 | 5 | 4 |
| L2 | Day | 53 | 0 | 1 | 1 | 0 | 0 | 14 |
| | Night | 96 | 0 | 0 | 1 | 0 | 0 | 13 |
| L3 | Day | 114 | 7 | 0 | 1 | 0 | 0 | 18 |
| | Night | 94 | 4 | 2 | 0 | 0 | 0 | 1 |
| ***Little Cherry Creek*** | | | | | | | | |
| LC1 | Day | 11 | 0 | 0 | 0 | 0 | 0 | 15 |
| | Night | 11 | 0 | 0 | 0 | 0 | 0 | 17 |
| LC2 | Day | 5 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Night | 35 | 0 | 0 | 0 | 0 | 0 | 0 |
| LC3 | Day | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Night | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Poorman Creek*** | | | | | | | | |
| Po1 | Day | 62 | 0 | 0 | 1 | 0 | 0 | 11 |
| | Night | 72 | 0 | 0 | 2 | 0 | 0 | 1 |
| Po2 | Day | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Night | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Ramsey Creek*** | | | | | | | | |
| Ra2 | Day | 28 | 0 | 1 | 0 | 0 | 0 | 1 |
| | Night | 24 | 0 | 2 | 0 | 0 | 0 | 0 |
| Ra3 | Day | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Night | 35 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra4 | Day | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Night | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: Kline Environmental Research and Watershed Consulting 2005a.

Abundance and number of fish species were greatest in Libby Creek during the 2005 surveys (Table 61). Brook trout, a non-native species, were first collected in Libby Creek within the analysis area in 2004 (Kline Environmental Research 2004). During the 2005 survey, brook trout outnumbered bull trout by a nearly 8 to 1 ratio at the Libby Creek sites. Longnose dace and large-scale suckers were only seen at the most downstream Libby Creek site during the nighttime snorkeling surveys. Sculpin were most abundant at this site, and also were seen in higher numbers during the night surveys (Kline Environmental Research and Watershed Consulting 2005a).

The only fish observed in Little Cherry Creek in the 2005 study were *Oncorhynchus* sp. (Table 61), consistent with the initial baseline survey. *Oncorhynchus* sp. was also the only trout species observed in Poorman Creek in the 2005 study, although bull trout were documented in the 1988 surveys, as well as surveys conducted afterward. No fish were seen upstream of the first

permanent fish barrier in Poorman Creek (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005b). Both bull trout and *Oncorhynchus* sp. were observed in Ramsey Creek. Bull trout were not seen at the upper Ramsey Creek site as was reported in the initial baseline survey. As with Poorman Creek, no fish were observed in Ramsey Creek upstream of the first permanent barrier to all fish (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005b).

### *3.6.3.5.2 Lower Clark Fork River Drainage Fish Populations*

#### Rock Creek Fish Populations and Genetics

During the initial baseline surveys in 1988, westslope cutthroat trout were the dominant trout species in East Fork Rock Creek, comprising 71 percent of all trout collected and having a density of 10 trout/100 $m^2$ (Table 60). Many of the westslope cutthroat trout collected from the Rock Creek Meadows site near the outlet of Rock Lake were thought to be hybridized with Yellowstone cutthroat trout and rainbow trout. Bull trout also were collected during these surveys at densities of 4 trout/100 $m^2$. The trout scales analyzed for age and growth during the 1988 baseline survey indicated that most trout within the analysis area were young (age I, II, and III), as is typical for low productivity mountain headwater streams as older fish reside in larger downstream areas. Older bull trout and westslope cutthroat trout (age IV and/or V) also were found in East Fork Rock Creek and Rock Creek Meadows, respectively. As in the Libby Creek drainage streams, growth rates for all age classes were low, likely due to limitations caused by the low nutrient concentrations and harsh environmental conditions.

In addition to the bull trout and westslope cutthroat trout observed in East Fork Rock Creek during the initial baseline survey, brook trout, brown trout (*Salmo trutta*), Yellowstone cutthroat trout, rainbow trout, and westslope/Yellowstone/rainbow trout hybrids also occur in Rock Creek and East Fork Rock Creek. Fish populations from one or more sites in East Fork Rock Creek and Rock Creek were surveyed in 1985, 1986, 1988, 1993, 1996, and 2000-2007 (USDA Forest Service and DEQ 2001; FWP 2008a). While only presence-absence data or counts were recorded for many of these earlier surveys, most surveys since 2000 measured trout densities using depletion estimates over about 100 meters of stream (Horn and Tholl 2008). Total trout densities recorded from surveys in East Fork Rock Creek as summarized by the USDA Forest Service and Montana Department of Environmental Quality (2001) ranged from 13 to 36 trout/100 $m^2$, with westslope cutthroat trout comprising from 69 to 93 percent of the total trout collected during the 1985 to 2000 period. Bull trout were the only other trout species collected in these surveys, and they were collected at densities up to 11 trout/100 $m^2$ during this time period. More recent data indicate a gradual increasing trend in bull trout from 2001 to 2007 with bull trout increasing from 7 to 26/100 m over that time period (Horn and Tholl 2008). Westslope cutthroat trout have ranged from 51 to 109/100 m over this latter time period.

In the mainstem of Rock Creek, total trout densities were generally lower than in the East Fork Rock Creek, but reached up to 32 trout/100 $m^2$, with westslope cutthroat trout also dominating the fish populations in most surveys (as summarized in USDA Forest Service and DEQ 2001). Brook trout were the dominant species in downstream reaches during two surveys in 1993 and 1996. Based on these surveys and the surveys documented in the MFISH database (2008a), brook trout appear to only inhabit the downstream reaches of Rock Creek. Bull trout were collected in low densities in some surveys in the mainstem Rock Creek, but generally were collected less frequently and in lower densities than in East Fork Rock Creek (USDA Forest Service and DEQ 2001).

The initial baseline study discusses results of genetic analyses from fish collected in 1984 (Western Resource Development Corp. 1989a; FWP 2008a) from near the mouth of Rock Creek and near the Rock Creek Meadows site. Based on the results of these analyses, the westslope cutthroat population at the mouth of Rock Creek was considered pure, but subject to genetic invasion, while the Rock Creek Meadows population was considered to be hybridized (92.8 percent westslope cutthroat trout, 5.2 percent Yellowstone cutthroat trout, and 2 percent rainbow trout) (Western Resource Development Corp. 1989a). Past stocking activities in Rock Lake or Rock Creek Meadows are responsible for this hybridization. East Fork Rock Creek has barriers to upstream fish movement in Rock Creek Meadows and at the outlet of Rock Lake, but these barriers do not prevent downstream fish passage. Hybridized cutthroat trout have access into areas occupied by pure strains (USDA Forest Service and DEQ 2001; Washington Water Power Company 1996).

As part of Avista's monitoring of bull trout in Rock Creek and Bull River, 10 radio tagged bull trout were detected between 2003 and 2007 moving into Rock Creek, including one fish that was detected in the drainage 2 years in a row. Observations of these radio tagged fish along with capture of migratory sized adult bull trout in weir traps installed in Rock Creek indicate low, but stable red count numbers over the years. In 2007, an adult bull trout captured below Cabinet Gorge Dam had previously been captured as a juvenile in Rock Creek in 2005 was transported and released in Rock Creek. Additional information about Avista's monitoring is reported in Lockard *et al.* 2003, 2004a; Lockard *et al.* 2004b; Lockard and Hintz 2005; Lockard *et al.* 2005; Hintz and Lockard 2006, 2007; Lockard *et al.* 2008; Bernall and Lockard 2008.

### East Fork Bull River Fish Populations and Genetics

The East Fork Bull River was not surveyed as part of the initial baseline study, but was surveyed between 1992 and 1994, 1999, and 2000-2007 (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; Horn and Tholl 2008; FWP 2008a). Results from these surveys indicate that brook trout, brown trout, bull trout, westslope cutthroat trout, mountain whitefish, sculpin, and northern pikeminnow (*Ptychocheilus oregonensis*) are present in the East Fork Bull River. While no density estimates were available from the MFISH database, fish densities were reportedly high for cutthroat trout and brown trout during the 1992-1994 surveys, and lower for bull and brook trout (Washington Water Power Company 1996). Fish densities were estimated from snorkeling surveys within four reaches of the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000). Westslope cutthroat trout and bull trout were found in all four reaches of the East Fork Bull River. In all reaches, westslope cutthroat trout were the dominant species, with densities up to 2 trout/100 $m^2$. Based on these estimates, the East Fork Bull River had about 2,600 westslope cutthroat trout present throughout its length.

Bull trout were collected at considerably lower densities than westslope cutthroat trout in the East Fork Bull River in 1999, with all reaches having less than 1 trout/100 $m^2$ (Chadwick Ecological Consultants, Inc. 2000). Generally, bull trout densities were highest in the upstream reaches of this stream. The East Fork Bull River was estimated to have about 200 bull trout present throughout its length. Subsequent sampling in the East Fork Bull River since 2000 has shown estimates of up to 7.3 trout/100 m in 2003 in downstream areas to as high as 43 bull trout/100 m in more upstream reaches in 2005 (Horn and Tholl 2008). Surveys of reaches in other streams within the Bull River drainage in 1999 indicated that the majority of the bull trout in this watershed are found in the East Fork, with 85 percent of the all the bull trout collected in the Bull River watershed collected from the East Fork Bull River. Of the other fish species collected in the

East Fork Bull River, brown trout, brook trout, and mountain whitefish were observed in one or both of the two downstream reaches, while sculpin were observed in all but the most upstream reach (Chadwick Ecological Consultants, Inc. 2000). Results from sampling from 2000 through 2007 by Avista show similar patterns (Horn and Tholl 2008).

The additional surveys recorded in the MFISH database (2008a) only gave the number of fish collected, but these numbers indicated that trout density is relatively high in the East Fork Bull River, particularly near the confluence with the Bull River. Brown trout was the dominant fish species in most of these surveys, but westslope cutthroat, brook trout, and mountain whitefish were collected in high numbers during many of the surveys. Sampling by Avista found similar results, with brown trout generally being the most abundant species in the lower reaches, but bull trout, brook trout, mountain whitefish, and westslope cutthroat trout also being present (Horn and Tholl 2008). Northern pike minnows and sculpins were collected more rarely and generally in low numbers (Chadwick Ecological Consultants, Inc. 2000; FWP 2008a). Fish found in the upper reaches within the CMW included bull trout, westslope cutthroat trout, and slimy sculpin (FWP 2008a).

Length-frequency data and scale analysis conducted during the 1999 survey suggest that the migratory life form of bull trout exists in the Bull River drainage. Resident bull trout also may exist in the drainage, as some younger trout within the size range expected for resident trout were observed. The absence of "resident" fish past age III raises uncertainties about the existence of a true resident population (Chadwick Ecological Consultants, Inc. 2000). Research has shown radio tagged bull trout transported from Lake Pend Orielle moving to the East Fork Bull River. The genetic information, sampling surveys, and telemetry indicated that this population is primarily a migratory population (Katzman and Hintz 2003).

Genetic analysis of bull trout tissues collected in 1993 from three locations on the East Fork Bull River indicated that the bull trout populations were pure. Genetic analyses conducted on westslope cutthroat trout tissues in 1983, 1984, and 2004 also determined that these populations were pure (FWP 2008a).

#### *3.6.3.5.3 Fisher River Drainage Fish Populations and Genetics*

All of the alternative transmission line alignments would follow or cross streams within the Fisher River watershed. Brook trout, bull trout, rainbow trout, mountain whitefish, largescale suckers, longnose dace, longnose suckers (*Catostomus catostomus*), redside shiners (*Richardsonius balteatus*), and sculpin are listed as residing in the reach of the Fisher River (FWP 2008a). Genetic surveys conducted on 90 rainbow trout collected from three locations in the upstream portion of the Fisher River in 2005 indicate these are pure interior redband trout.

Additionally, one or more of the transmission line alternatives follows and/or crosses West Fisher Creek and Miller Creek, all of which are tributaries to the Fisher River. The MFISH database lists brook trout, bull trout, redband trout, mountain whitefish, rainbow trout, sculpin, and westslope cutthroat trout as occurring in West Fisher Creek. Surveys of this stream were conducted in 1987, 1993, and 2002-2004, and documented the collection of rainbow trout, brook trout, bull trout, and mountain whitefish. Surveys conducted near the confluence of West Fisher Creek and the Fisher River indicate that rainbow trout were the dominant species. Only bull trout were collected from the surveys conducted about 3.7 miles upstream of the confluence. Tissues from 25 trout collected in 2000 from West Fisher Creek underwent genetic analysis and were determined to be westslope/rainbow trout hybrids. Miller Creek, a tributary to the Fisher River is reported to

contain brook trout, redband trout, pure westslope cutthroat trout, redband/cutthroat hybrids, slimy sculpin, and torrent sculpin, with genetic analysis indicating that the westslope cutthroat trout were 100 percent pure (FWP 2008a).

#### *3.6.3.5.4 Analysis Area Lakes*

Rock Lake, St. Paul Lake, Howard Lake, Ramsey Lake, Upper Libby Lake, and Lower Libby Lake are within the analysis area. While no fish population data were available for Ramsey Lake, St. Paul Lake or the Libby Lakes, the MFISH database (2008a) indicates that Yellowstone cutthroat/westslope cutthroat trout hybrids inhabit Rock Lake. Nineteen fish were collected in Rock Lake in 1988, with some thought to be pure westslope cutthroat trout and other hybrids (Western Resource Development 1989). Genetic analyses were conducted on trout from this lake in 1985 and 1993. Results of both analyses were similar, and indicated that the fish are hybridized in Rock Lake, containing between 79 percent and 82 percent westslope cutthroat trout genes, and between 18 percent and 21 percent Yellowstone cutthroat trout genes. Based on the MFISH database, stocking of rainbow trout in Rock Lake occurs annually. In Howard Lake, non-native rainbow trout are considered abundant and are stocked annually by FWP (FWP 2008a).

### 3.6.3.6 Spawning Surveys

In October 1989, about 22 miles of Libby, Ramsey, and Poorman creeks were surveyed for bull trout redds (spawning nest made by trout) as part of the initial baseline study. Two spawning areas made by large, apparently migratory bull trout were found downstream of the project. Above the falls, 10 small bull trout redds also were found, which were the product of resident fish. No bull trout spawning activity was observed in Ramsey Creek or Poorman Creek. Also, no spawning or spent bull trout or mountain whitefish were observed in the 11-mile portion of Libby Creek surveyed during the November 1988 mountain whitefish survey (Western Resource Development Corp. 1989a; Kline Environmental Research 2004). Additionally, 18 redds were observed in West Fisher Creek in 1999, and 23 redds were observed in 2000.

Redd surveys also were conducted in October 1995 and 1996 in Libby, Ramsey, Poorman, and Little Cherry creeks. Four possible redds were noted, one on Libby Creek upstream of its confluence with Little Cherry Creek, and three on Ramsey Creek. The three redds identified on Ramsey Creek were noted as possibly being brook trout redds (Kline Environmental Research 2004), but are more likely to have been bull trout redds because surveys have not reported brook trout as occurring in Ramsey Creek. As part of the mitigation efforts for the construction and operation of Libby Dam, redd surveys were conducted on Bear Creek annually from 1995 through 2004. About 4 miles were surveyed on each occasion, with the number of bull trout redds observed ranging from four in 2001 to 36 in 1999 (Dunnigan *et al.* 2004, 2005).

Redd surveys also have been conducted by the FWP and KNF within the Fisher River, East Fork Bull River, and Rock Creek watersheds. The Fisher River watershed was surveyed for redds in 1993, with one suspected bull trout redd observed in the Fisher River itself, and 12 redds observed within other tributaries in the drainage (Kootenai Tribe of Idaho and FWP 2004).

The East Fork Bull River has been surveyed for both brown and bull trout redds (Washington Water Power Company 1996; Avista Corp. 2007). Brown trout redds were surveyed from 1980 through 1982, with an average of 33 redds observed each year. Surveys for bull trout redds were begun in 1992, with 12 redds observed. Both bull trout and brown trout redd surveys were conducted in 1993, 1994, and 1995. Three brown trout redds were observed in 1993, but no bull

trout redds were found. Accurate redd counts were not possible in 1994 and 1995 due to high flows (Washington Water Power Company 1996). Bull and brown trout redd surveys also were conducted on the East Fork Bull River and Rock Creek from 2001 to 2007 by Avista (Storaasli and Moran 2008). The number of bull trout redds in the East Fork Bull River ranged from nine in 2004, 2005, and 2007 to a high of 32 in 2002. Brown trout redd surveys during this same time period for East Fork Bull River ranged from five in 2006 to 46 in 2002 (Storaasli and Moran 2008).

Washington Water Power Company (1996) also conducted redd surveys on Rock Creek in 1993-1995. As in the East Fork Bull River, the redd surveys in 1994 and 1995 did not result in accurate counts due to high flow conditions. Only a single bull trout redd was found in Rock Creek during the 1993 survey. In the Avista surveys, bull trout redds in Rock Creek ranged from zero in 2001 to six in 2004 (Storaasli and Moran 2008).

### 3.6.3.7 Heavy Metal Concentrations in Fish Tissues

Concentrations of copper, lead, mercury, zinc, and cobalt in redband trout tissues collected in 1988 are shown in Table 62. Mercury concentrations were measured in muscle tissue, while all other metal concentrations (*e.g.*, copper, lead, and zinc) were measured in liver tissue (Western Resource Development Corp. 1989). The current water quality criteria level for mercury in fish tissues for the protection of human health is 0.3 mg/kg whole body wet weight (Environmental Protection Agency 2001). The initial baseline study report (Western Resource Development Corp. 1989a) does not specifically state if the results listed in Table 62 were based on wet weight or dry weight, although it does mention that "it was difficult to weigh the frozen samples due to loss of moisture." Based on this, the best assumption is that the samples were intended to be weighed as wet weight. All mean concentrations of mercury in the sampled fish were below the level set by the EPA. Regulatory criteria for metal concentrations in fish tissues have not been established for the remaining metals. The trout used for the metals analyses were collected from a reach on Libby Creek located below all potential tailings and facility sites, in order to provide baseline data for metal levels regardless of the locations of these structures.

**Table 62. Metals Concentrations in Redband Trout in Libby Creek.**

| Metal | Minimum Metal Concentration (µg/g) | Maximum Metal Concentration (µg/g) | Average Metal Concentration (µg/g) |
|---|---|---|---|
| Cobalt | 0.1 | 12.4 | 1.9 |
| Copper | 2.4 | 29.4 | 6.5 |
| Lead | <0.1 | <1.4 | <0.5 |
| Mercury | 0.1 | 0.4 | 0.19 |
| Zinc | 22.3 | 62.8 | 30.1 |

µg/g = microgram per gram.
Note: Mercury concentrations were measured in muscle tissue, while all other metal concentrations were measured in liver tissue. Results given were not specified as wet weight or dry weight measurements, but are presumed to be based on wet weight.
Source: Western Resource Development Corp. 1989a.

Metals concentrations also were analyzed in westslope cutthroat trout tissues collected from Rock Creek and East Fork Rock Creek in 1985, as reported in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). In East Fork Rock Creek, mean copper concentrations were 3.0

microgram per gram (μg/g), mean zinc concentrations were 75.0 μg/g, and mean mercury concentrations were 0.1 μg/g. In the mainstem Rock Creek, mean copper concentrations were 3.0 μg/g, mean zinc concentrations were 82.0 μg/g, and mean mercury concentrations were 0.1 μg/g. Mercury concentrations were measured in muscle tissue similar to the tissue from fish collected in the Libby Creek drainage. Copper and zinc concentrations were measured in gill tissue. These concentrations are assumed also to be based on wet weights. Copper and mercury concentrations in samples from Rock Creek and East Fork Rock Creek fish were generally less than concentrations in samples from Libby Creek fish, while zinc concentrations were substantially higher.

#### 3.6.3.8 Historical Impacts on Fisheries

Baseline aquatic data reflect the influences of historical mining activities on fishery and habitat conditions in Libby Creek. Prior to the 1860s, the upper valley was essentially intact, influenced primarily by wildfires and floods. While Native Americans used the upper valley for subsistence purposes (harvesting berries and wildlife), upper Libby Creek was not among those streams routinely used for fishing (USDA Forest Service *et al.* 1992).

In 1867, placer mining began in Libby Creek and its tributaries, including the analysis area (Kline Environmental Research 2004). By 1868, about 800 miners were working the bed of Libby Creek and its tributaries, diverting streams, and cutting timber for housing and placer works. Left behind were scattered patches of disturbed streambed, floodplains devoid of timber, and degraded aquatic habitat.

In 1887, the mining community of Old Libby was established in the area. From the mid-1890s to 1937, hydraulic mining extended impacts on fisheries in the upper valley of Libby Creek within the analysis area (Kline Environmental Research 2004). After excavating and washing old stream channels, floodplains, and streambanks for gold and silver, the "waste" was left in place or allowed to wash down river. Use of mercury in the processing of ore increased, and mercury is found currently in area streams.

The upper Libby Creek drainage burned in 1889 and 1910, the valley was virtually stripped of all standing timber, and little habitat or fish resources were left to be affected by mining. Photos from the period indicate that Libby Creek was a wide, shallow stream with a cobble/gravel substrate. Howard Lake still remained a fishery after the 1910 fire. The few stream fish that remained after the 1910 fire probably were restricted to the headwaters, where only placer mines had been. Howard Lake and Libby Creek had regular stocking beginning in the late 1920s. In 1914, steam-operated mining equipment was used in Libby Creek. Large draglines and steam shovels dug into the bed and floodplain. Heavy equipment and hydraulic mining continued into the 1940s, after which time only a few placer mines remained. Additionally, timber was harvested on private land in the upper Libby Creek drainage in the 1950s. The first non-native fish (western coastal rainbow trout from California and brook trout from the eastern United States) were imported by rail in 1914 and released in local streams (USDA Forest Service *et al.* 1992).

Eighty years of mining and periodic wildfire in upper Libby Creek and the lower end of its tributaries limited available fish habitat throughout the Libby Creek drainage. The fish habitat that remained was concentrated in the upper headwaters of tributaries, including Bear, Ramsey, and Poorman creeks. Re-growth of conifers has begun to stabilize the stream system in the upper valley (USDA Forest Service *et al.* 1992).

### 3.6.3.9 Threatened and Endangered Fish Species

Bull trout occur in analysis area streams and are currently listed as threatened by the USFWS. The USFWS also has designated bull trout critical habitat in the analysis area in segments of Rock Creek, East Fork Rock Creek, Libby Creek, Poorman Creek, Ramsey Creek, and West Fisher Creek (Figure 56).

#### *3.6.3.9.1 Description of the Population Area*

Historically, bull trout were likely distributed throughout the Libby Creek, East Fork Bull River, Rock Creek, and Fisher River watersheds. The current bull trout populations within the analysis area are composed of both a resident and a fluvial/adfluvial (stream/lake) component (FWP 2008a). Bull trout have been reported from both upstream and downstream of the Libby Creek Falls on Libby Creek, as well as within Bear Creek, Poorman Creek, Ramsey Creek, East Fork Rock Creek, Rock Creek, West Fisher Creek, Fisher River, and the East Fork Bull River (Figure 56); (Western Resource Development Corp. 1989a; Chadwick Ecological Consultants, Inc. 2000; Kline Environmental Research 2004; FWP 2008a). Bull trout spawning has also been documented within the Libby Creek watershed, with redds located in Libby Creek (both upstream and downstream of the falls), Bear Creek, and possibly in Ramsey Creek (the redds located were not definitively determined to be bull trout redds). Additionally, redd surveys have documented bull trout spawning in the Fisher River, East Fork Bull River, and Rock Creek watersheds (Washington Water Power Company 1996; USFWS 2002).

#### *3.6.3.9.2 Subpopulation Size*

As summarized in section 3.6.3.5.1, *Libby Creek Drainage Fish* Populations, spawning surveys conducted from 1988 to 2004 identified bull trout redds during one or more of the surveys in reaches in Libby Creek, Ramsey Creek, and Bear Creek. Bear Creek appears to be used most frequently for bull trout spawning, with up to 36 redds identified during surveys.

Bull trout densities in the Libby Creek watershed ranged up to 13 fish/100 m based on data collected from 1989 through 2005 (Western Resource Development Corp. 1989; Kline Environmental Research 2004; Kline Environmental Research and Watershed Consulting 2005a; FWP 2008a). While limited data exist for the Rock Creek and East Fork Bull River watersheds, most survey data indicate relatively high densities of bull trout in these streams compared to streams within the Libby Creek drainage. Bull trout appear to be less numerous in the Fisher River watershed, but data are limited for this drainage. Based on these numbers and spawning survey data, the bull trout subpopulation, although viable, is small in the Libby Creek watershed. Rock Creek and the East Fork Bull River likely support larger subpopulations of bull trout.

In the East Fork Bull River, 24 to 101 juvenile bull trout were captured annually between 2000 and 2004, for a total of 327 trout. In Rock Creek, 17 to 55 bull trout were collected annually between 2001 and 2004, for a total of 137 trout over the 4-year period. These data support the contention that Rock Creek is secondary to the Bull River in terms of recruitment of juvenile bull trout to the Cabinet Gorge Reservoir, although Rock Creek has steadily contributed trout (USFWS 2006). Bull trout redds have been observed in the East Fork Bull River and Rock Creek. Redd surveys by Avista (Storaasli and Moran 2008) indicate that East Fork Bull River, and to a lesser extent Rock Creek, are two primary spawning streams that support the Cabinet Gorge bull trout population (Montana Bull Trout Scientific Group 1996).

#### *3.6.3.9.3 Growth and Survival*

Data to determine growth rates for the bull trout subpopulations within analysis area streams are limited. The only age and growth analysis data for the Libby Creek watershed were collected during the 1988 initial baseline data survey and were summarized in section 3.6.3.5.1, *Libby Creek Drainage Fish Populations*. Based on this analysis data, most bull trout within the Libby Creek drainage are young, as is typical for low-productivity mountain-headwater streams. Older bull trout were only found in the upstream portions of Libby Creek and Ramsey Creek, and in East Fork Rock Creek. Growth rates for all age classes were low, likely due to limitations caused by low nutrient concentrations. Data to determine survival rates for the Libby Creek drainage subpopulation are insufficient.

Bull trout growth in Rock Creek and the East Fork Bull River was relatively low when compared with other tributaries to the lower Clark Fork River (Washington Water Power Company 1996). Instantaneous survival rates for age III+ bull trout were 18 percent for the East Fork Bull River and 23 percent for Rock Creek. These survival rates were lower than the average for the other tributaries to the lower Clark Fork River (Washington Water Power Company 1996).

#### *3.6.3.9.4 Life History Diversity and Isolation*

Bull trout are widely distributed throughout the lower Kootenai River watershed, with spawning and rearing by migratory adults occurring in tributaries that drain British Columbia, Idaho, and Montana. The Libby Creek population has both a resident and a fluvial/adfluvial, migratory life history form. The resident population is isolated from the rest of the bull trout within and downstream of the analysis area by Libby Creek falls, which is located about 1.2 miles upstream of the Howard Creek confluence. The migratory population spends their adult lives in Kootenay Lake or the Kootenai River, with upstream migration limited by Libby Dam, which is impassable to bull trout moving upstream, but not downstream. Spawning and rearing of bull trout have been documented in Libby Creek and the Fisher River, as well as other Kootenai River tributaries (Western Resources Development Corp. 1989a; USFWS 2002; FWP 2008a). Specific spawning data within the upper Libby Creek watershed are limited, but the observation of redds has established that bull trout do use portions of Libby Creek, Bear Creek, and possibly Ramsey Creek for spawning (Western Resource Development Corp. 1989a; Dunnigan *et al.* 2005). It is not clear if these redds were from resident or fluvial bull trout.

Bull trout in the East Fork Bull River and Rock Creek are included in the Cabinet Gorge core area within the Lower Clark Fork River Recovery Unit (USFWS 2002), and are isolated from the bull trout populations in the lower Kootenai River watershed. East Fork Bull River and Rock Creek are considered important spawning streams for this subpopulation (Montana Bull Trout Scientific Group 1996) and redd surveys by Avista support this contention. Bull trout populations within these streams may include both resident life history forms and fluvial/adfluvial migratory life history forms (FWP 2008a); however, the occurrence of resident bull trout in East Fork Bull River is uncertain (Chadwick Ecological Consultants, Inc. 2000). Observations of smaller redds indicative of resident bull trout and observations of large bull trout that are presumed to be migratory fish based on their size indicate that both the resident and fluvial/adfluvial life forms exist in Rock Creek (Montana Bull Trout Scientific Group 1996). More recent research has shown radio tagged bull trout transported from Lake Pend Orielle moving to the East Fork Bull River. Genetic information, sampling surveys, and telemetry indicate this population is primarily a migratory population (Katzman and Hintz 2003).

The bull trout population in Rock Creek is considered to be composed primarily of resident fish (USFWS 2003). Migratory fish do use the stream as demonstrated by radio tagged bull trout tracked to this stream (Hintz and Lockard 2007). Two reaches of Rock Creek, including a reach located near the confluence with the Clark Fork River, are intermittently dewatered and may act as seasonal barriers to fish passage (USFWS 2007a; FWP 2008a).

##### *3.6.3.9.5 Persistence and Genetic Integrity*

The bull trout populations that occur in the Libby Creek and Fisher River watersheds are part of the Kootenai River/Kootenay Lake primary core area (USFWS 2002). A primary core area indicates that good connectivity exists within the area, with large lakes and migratory corridors present. Six local populations have been documented in the Kootenai River/Kootenay Lake core area, with one of these populations estimated as having greater than 100 individuals, and three others, including the population in Libby Creek, estimated as having numbers approaching 100 individuals. If a core area has five local populations with 100 or more spawning adults and 1,000 or more adult fish, it is assumed to consist of enough individuals to protect genetic integrity and be less vulnerable to the effects of environmental instability (USFWS 2002). Section 3.6.3.1.2, *Barriers to Fish* Passage discusses barriers on analysis area streams to bull trout. While the isolated, resident bull trout population that inhabits the upstream portion of Libby Creek has persisted for many years, it is more vulnerable to extirpation via catastrophic events such as droughts, landslides, floods, or fire than the trout in the watershed downstream of the falls.

The bull trout populations within the Lower Clark Fork Recovery Unit, which includes Rock Creek and the East Fork Bull River, continue to persist, although sometimes in low numbers, in the watersheds where they likely occurred historically. Migratory trout life history forms have largely been replaced by resident trout life history forms in many of the tributaries, limiting genetic diversity and increasing the risk of local extinctions (Montana Bull Trout Scientific Group 1996; USFWS 2002). The presence of migratory bull trout has been established in both Rock Creek and the East Fork Bull River (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000). Bull trout with migratory life histories are necessary for the long-term success of the species because generally they are more resilient and more resistant to environmental variation and stressors (Rieman and Mcintyre 1993; Montana Bull Trout Scientific Group 1996). The upstream and downstream transport program for bull trout conducted by Avista aids in ensuring the long-term success of this life history trait.

The presence of brook trout threatens the persistence and the genetic integrity of bull trout within the analysis area. The probability of hybridization and displacement from competition is high. The presence of brook trout has been documented downstream of the analysis area in the lower Libby Creek drainage for many years, and were first documented in upper Libby Creek drainage in 2004 and in the Fisher River drainage in 1986 (FWP 2008a). During the 2005 surveys of the Libby Creek drainage, brook trout were almost eight times as numerous as bull trout at the Libby Creek sites surveyed (Figure 53). Brook trout threaten the persistence and genetic integrity of bull trout through the probability of displacement by competition or hybridization. No genetic analyses have been performed on the bull trout within the Fisher River watershed to determine if hybridization has occurred. Genetic analysis in the upper Libby Creek drainage found no indication of hybridization (Arden *et al.* 2007). Brook trout hybridization is suspected in O'Brien Creek, a Kootenai River tributary located farther north in the basin. Additionally, a 25 percent hybridization rate was detected from a sample of 24 bull trout from the Kootenai River (USFWS 2002). The subpopulation of bull trout that inhabit Libby Creek upstream of Libby Creek Falls is

assumed to be protected from the threat of hybridization with brook trout because the barrier created by the falls prevents brook trout from accessing that portion of the stream.

Within the Cabinet Gorge core area, genetic analyses on bull trout from three reaches of the East Fork Bull River were conducted in 1993. Almost 60 trout were tested; none showed signs of hybridization. Brook trout are present in most streams in the lower Clark Fork River drainage that currently support bull trout, including Rock Creek and the East Fork Bull River. Additionally, brook trout are known to be extensively hybridized with bull trout in Mission Creek (USFWS 2002; FWP 2008a), a tributary to the Flathead River that is within the same Recovery Unit as the East Fork Bull River and Rock Creek.

#### *3.6.3.9.6 Designated Critical Habitat*

Within the mine analysis area, three segments of Libby Creek, and short segments of Poorman and Ramsey creeks are designated critical habitat within the Libby Creek drainage (Figure 56).The segments on Poorman and Ramsey creeks are at their confluence with Libby Creek. The longest segment on Libby Creek extends from the confluence with Howard Creek to downstream of Poorman Creek, and is about 3.5 miles. The Libby Adit and LAD Areas in all alternatives and the Libby Plant Site and Poorman Impoundment Site in Alternatives 3 and 4 are west of this segment. Another segment of critical habitat is found on MMC's property downstream of the Little Cherry Creek Impoundment Site. The third segment of Libby Creek in the analysis area is a short segment near the confluence with Hoodoo Creek, downstream of all facilities in all alternatives. A total of 14.4 miles of designated critical bull trout habitat, 9.9 miles of which are in the analysis area, occurs on Libby Creek and the two tributaries (Figure 56).

All segments of designated critical habitat on Libby Creek are on Montana's 303(d) list of water quality-impaired streams. Aquatic life support and cold-water fishery uses are only partially supported for this reach. Probable causes listed by the DEQ are alteration in stream-side or littoral vegetative covers, mercury exceedances, and physical substrate habitat alterations likely resulting from impacts from abandoned mine lands and placer mining. Historical effects of mining and periodic wildfire in upper Libby Creek have limited available fish habitat throughout the Libby Creek drainage. Recent habitat data on Libby Creek suggest that riparian vegetation and bank stability are improving in the area. Pool habitat and large woody debris, which are important components of bull trout habitat, are present throughout Libby Creek (Table 54 through Table 57).

Two segments of designated critical habitat, one 0.9 mile and the other 1.2 miles long, are found on West Fisher Creek. These two segments are along the Alternative E transmission line corridor. West Fisher Creek has pools and large woody debris throughout most of its length. The exception is near the mouth of the stream where it becomes very wide. Bank stability is variable, but there is adequate habitat to support fish through the reaches of critical habitat (Table 58).

Critical habitat in the Rock Creek drainage is designated at five separate locations. Four sections are located on the mainstem and one section is located on the East Fork (above the confluence with the West Fork) (Figure 56). The total amount of designated critical habitat on Rock Creek and East Fork Rock Creek is 2.9 miles (USFWS 2007a). All segments of designated critical habitat on Rock Creek are on Montana's 303(d) list. Probable causes for the Rock Creek impairment are other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities. All five designated stream segments contain some, or all, of the critical elements that support bull trout. Two seasonally dewatered segments of the

mainstem of Rock Creek encompass all or portions of four of the five critical habitat sections. The extent of critical habitat area that is affected annually depends on year-round streamflow conditions. In most years, habitat is adversely affected to some degree due to the seasonal lack of connectivity preventing upstream movement of adult migratory bull trout. Annual subsurface streamflow conditions in summer and early fall severely affect the ability of bull trout to find suitable spawning areas. Consequently, it is likely that reproduction in most years is significantly limited (USFWS 2007a).

### 3.6.3.10 Sensitive Fish Species

Westslope cutthroat trout and interior redband trout are Forest Service sensitive species and inhabit streams within the analysis area.

#### *3.6.3.10.1 Westslope Cutthroat Trout*

**Description of the Population Area**

Historically, westslope cutthroat trout were likely distributed throughout the analysis area within the Kootenai and Clark Fork River watersheds. Based on the results of genetic analyses, no pure westslope cutthroat trout populations have been found to inhabit the Libby Creek watershed within the analysis area. The hybrid trout populations in Ramsey Creek, Bear Creek, Little Cherry Creek, and segments of Libby Creek downstream of the mine area include rainbow/westslope cutthroat and redband/westslope cutthroat trout hybrids (Kline Environmental Research 2004). The trout tissues tested showed only slight hybridization of the rainbow or redband trout with westslope cutthroat trout, containing 2 percent or less westslope cutthroat trout genes. Genetic analyses of westslope cutthroat trout in Bear Creek near the Libby Creek confluence indicated the fish are likely redband/cutthroat trout hybrids.

Results from genetic analyses indicated that the westslope cutthroat trout population in the East Fork Bull River is pure. Trout collected from Rock Creek also were found to be pure westslope cutthroat trout. Several trout collected from a section of East Fork Rock Creek near Rock Lake were found to be hybridized with Yellowstone cutthroat trout and rainbow trout. Likewise, genetic analyses on trout collected from Rock Lake indicated that all trout collected were westslope cutthroat trout/Yellowstone cutthroat trout hybrids (FWP 2008a).

In the Fisher River watershed within the analysis area, pure westslope cutthroat trout were collected from Miller Creek, and westslope cutthroat trout/rainbow trout hybrids were collected from near the mouth of Miller Creek (FWP 2008a). Pure westslope cutthroat trout have not been found in any other stream in the Fisher River watershed within the analysis area.

Based on these results, this species would not be impacted by the proposed activities within the Libby Creek watershed because pure westslope cutthroat trout are not present. They potentially could be affected from any activities within the Fisher River, East Fork Bull River, and Rock Creek watersheds.

**Subpopulation Size**

Limited survey data were available to indicate subpopulation size in the Fisher River, East Fork Bull River, or Rock Creek watersheds. None of the surveys conducted within the segment of the Fisher River within the reach potentially affected by the transmission line alternatives recorded any pure or hybridized westslope cutthroat trout, but survey data are limited. Likewise, while genetic analyses indicate that hybrid westslope cutthroat/rainbow trout inhabit West Fisher Creek,

no surveys reported any hybrid westslope cutthroat/rainbow trout. Surveys conducted in Miller Creek recorded westslope cutthroat trout and redband/westslope cutthroat trout hybrids, but did not give any density estimates. Relative abundance data from these surveys indicate that pure westslope cutthroat trout compose between 16 percent and 22 percent of the trout population in this creek, with hybridized redband/westslope cutthroat trout composing an additional 18 percent of the trout collected in one of these surveys (FWP 2008a). Within the Rock Creek watershed, a survey in three reaches of Rock Creek found westslope cutthroat trout at densities up to 79 trout/100 m. Other surveys also reported relatively high densities of westslope cutthroat trout within this watershed (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001), and westslope cutthroat trout were the dominant species in this stream in most surveys. Hybrid westslope cutthroat trout were collected from the more upstream reaches of Rock Creek and in Rock Lake. The hybridization in analysis area streams may be more widespread than reported, because reliably distinguishing between pure and hybridized westslope cutthroat trout in the field is difficult. The genetic analysis indicates that the hybrid trout are composed of 93 percent westslope cutthroat trout genes (FWP 2008a).

Westslope cutthroat trout are also relatively abundant in the East Fork Bull River (Washington Water Power Company 1996; Horn and Tholl 2008). They were generally the dominant species in this upper reaches of this stream (Washington Water Power Company 1996; Chadwick Ecological Consultants 2000; Horn and Tholl 2008). Westslope cutthroat trout in the Rock Creek and East Fork Bull River watersheds appear to be viable and thriving.

#### Growth and Survival

Limited data are available on growth rates and age class structure of westslope cutthroat trout within the analysis area. Data collected in 1986 and 1987 in East Fork Rock Creek and Rock Lake showed few to no young-of-year fish (age I) (Western Resource Development Corp. 1989a). The trout collected from Rock Lake appeared to have an older age structure than those collected from East Fork Rock Creek, but likely this resulted from the different sampling methods employed to collect trout from the lake (Western Resource Development Corp. 1989a). Growth rates during these surveys were described as low in comparison to other tributaries within the lower Clark Fork River drainage. The instantaneous survival rate of 23 percent was similar to the average for these streams. The East Fork Bull River was surveyed during the same time frame, with the oldest trout collected in the age III+ class. Growth rates and the instantaneous survival rate (26 percent) were similar to the average for the other tributaries within the drainage (Washington Water Power Company 1996). Growth and survival rates in the Rock Creek and East Fork Bull River watersheds appear to be similar or slightly lower than other streams in the lower Clark Fork River drainage.

#### Life History Diversity and Isolation

Westslope cutthroat trout populations within the Fisher River, Rock Creek, and East Fork Bull River drainages likely consist of both resident and fluvial life history forms. Little survey data that document the presence or absence of natural barriers within any of these watersheds are available. The only documented barriers to fish passage in East Fork Rock Creek are in the upstream reaches near Rock Lake. The Bull River and East Fork Bull River have no known physical barriers that prevent trout from accessing these streams from the Clark Fork River (Washington Water Power Company 1996). The presence of migratory westslope cutthroat trout have been documented in the East Fork Bull River (Katzman and Hintz 2003). Dewatering at the mouth of Rock Creek isolate fish in Rock Creek seasonally.

**Persistence and Genetic Integrity**

Based on the data provided from a limited number of genetic analyses, westslope cutthroat trout populations in the Fisher River drainage are largely hybridized, except for a pure population in Miller Creek (FWP 2008a). Unless barriers prevent rainbow and redband trout from accessing the upstream reaches of Miller Creek, the trout in the more upstream reaches of Miller Creek are vulnerable to hybridization.

Trout collected nearer to the outlet of Rock Lake, while still predominately westslope cutthroat trout, have Yellowstone cutthroat trout and rainbow trout genes (FWP 2008a). All trout collected in Rock Lake were identified as westslope cutthroat/yellowstone cutthroat trout hybrids. The seasonally dewatered sections of Rock Creek at the confluence of the Clark Fork River (FWP 2008a) may aid in protecting the purity of the westslope cutthroat populations by acting as a barrier to trout moving upstream during some parts of the year. Barriers to upstream fish passage in Rock Creek are in the upstream Rock Creek Meadows reach and at the outlet of Rock Lake. These barriers do not prevent the movement of fish in a downstream direction, indicating that hybridization of the pure trout within these reaches is possible (Washington Water Power Company 1996).

Results of genetic analyses of trout in the East Fork Bull River indicate the population is pure, and seems to have a lower chance of hybridization occurring because no rainbow, redband, or Yellowstone cutthroat trout have been collected in the surveys of this stream. No physical barriers exist in the Bull River mainstem or the East Fork Bull River that prevent the rainbow trout and hybrid trout present elsewhere in the drainage from moving upstream to hybridize this population (Washington Water Power Company 1996).

The persistence of westslope cutthroat trout in these drainages is also threatened by the presence of brook trout and brown trout, which may outcompete westslope cutthroat trout for available resources or prey upon them. In the East Fork Bull River, brown trout appear to be flourishing, dominating the fish populations at downstream sites during most surveys (Washington Water Power Company 1996; FWP 2008a). In 2007, non-native salmonid suppression activities were initiated (Moran and Storaasli 2008).

***3.6.3.10.2 Redband Trout***

**Description of the Population Area**

Historically, redband trout were distributed throughout much of the analysis area. Based on fish distribution surveys, redband trout and their hybrids are the dominant trout species within the Libby Creek watershed as well as in the upstream segment of the Fisher River. There were no records of redband trout from the Rock Creek and East Fork Bull River drainages (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; USDA Forest Service and DEQ 2001; FWP 2008a). Results of genetic analyses indicate that redband trout are largely hybridized throughout the Libby Creek watershed, but genetically pure redband trout have been collected from portions of Libby, Poorman, Bear, Ramsey, and Little Cherry creeks, and recently from the Fisher River (FWP 2008a).

No spawning surveys were available for redband trout. Fish distribution surveys and genetic analyses (Western Resource Development Corp. 1989a; Kline Environmental Research 2004; Kline Environmental Research and Watershed Consulting 2005a; Leary 2006) are the primary data for this subpopulation. Habitat surveys conducted in 1988 (Western Resource Development

Corp. 1989a) and in 2005 (Watershed Consulting and Kline Environmental Research 2005) supplement the fish distribution data.

### Subpopulation Size

While no redband trout redd surveys have been conducted in the Libby Creek or Fisher River watersheds, fish distribution surveys have shown that redbands and their hybrids are the dominant trout species within the analysis area in both watersheds, with densities up to 102 trout/100 m (Kline Environmental Research 2005a). Based on these numbers, the mixed redband population is viable and thriving in the Libby Creek watershed, with small populations of pure redbands in all of Little Cherry Creek and in segments of Poorman Creek, Libby Creek, Bear Creek, and Ramsey Creek. While no abundance data were available for the Fisher River, the population in the upstream portion of this river consists of pure redband trout.

### Growth and Survival

Data to determine growth rates for the Libby Creek drainage redband trout subpopulation are limited. The Libby Creek watershed within the analysis area is mainly inhabited by young trout, typical for headwater streams with low productivity. Available data have shown stable numbers of fish over time on streams where data were collected. Ramsey Creek was the only project stream in which older redband trout were collected. Growth rates for all age classes were low, probably due to low nutrient concentrations in these streams. Data to determine survival rates for the Libby Creek drainage subpopulation are insufficient.

### Life History Diversity and Isolation

The Libby Creek and Fisher River watersheds' redband populations likely have both resident and fluvial, migratory life history forms. Redband trout have been collected in recent surveys from the segment of Little Cherry Creek located upstream of a series of fish barriers, which are considered impassable for trout. The redband trout population in this stream appears to be genetically pure based on the recent 2005 genetic analyses (Leary 2006). Genetic analyses of redband trout in Poorman Creek and the Fisher River also indicate that these populations are pure, possibly also as a result of barriers that keep the trout isolated from downstream hybridized populations. In the case of the redband trout present in the Libby Creek mainstem and the Fisher River, complete isolation from other rainbow, westslope cutthroat, or hybrid trout is unlikely because these other trout species have been identified in tributaries within the analysis area (FWP 2008a). Migratory redband trout probably persist in the remainder of the Libby Creek watershed not isolated through barriers, as well as in the Fisher River watershed.

### Persistence and Genetic Integrity

Based on data provided from a limited number of genetic analyses, the redband trout population within the Libby Creek watershed consists mostly of redband/cutthroat and redband/rainbow trout hybrids. Some genetically pure redband trout have been collected in Libby Creek. Rainbow trout are stocked annually in Howard Lake (FWP 2008a) and likely access Libby Creek and its tributaries through Howard Creek. Genetic analyses have also shown that the redband populations in Ramsey Creek and Bear Creek are largely hybridized to a lesser extent with both rainbow and westslope cutthroat trout. Non-hybridized redband trout populations do persist in Poorman Creek and Little Cherry Creek, possibly due to the presence of barriers to fish moving upstream from Libby Creek. Leary (2006) reviewed the 1991, 1992, and 2005 genetic analyses results from trout in Little Cherry Creek and noted that substantial genetic changes had been observed in the redband trout population over a relatively short time period. These changes suggest there is a low

effective population size for redband trout in Little Cherry Creek. Non-hybridized redband trout also inhabit the upstream segment of the Fisher River, but they are likely vulnerable to hybridization because westslope cutthroat trout, rainbow trout, and hybrid trout exist in tributaries to this segment of the Fisher River and in downstream segments.

### 3.6.3.11 Tribal Treaty Rights

The Hellgate Treaty of 1855 reserved for the Kootenai Nation, among other rights, "the right to fish at all usual and accustomed places….on open and unclaimed lands." The KFP recognizes these treaty rights, and allows the Flathead/Kootenai-Salish Indian tribes to fish within the KNF. Additionally, the American Indian Religious Freedom Act allows Native Americans access to sites within the KNF that are still in use. Section 3.5, *American Indian Consultation* discusses American Indian rights.

### 3.6.3.12 Existing Watershed Conditions

The potentially affected threatened and sensitive fish species in analysis area streams include bull trout, redband trout, and westslope cutthroat trout. This analysis will focus on their habitat needs. Section 3.11, *Surface Water Hydrology* gives a more thorough review of the existing hydrologic conditions in the Libby Creek watershed.

The variables analyzed correspond to habitat indicators listed on the USFWS matrix for bull trout (USFWS 1998). Existing conditions for each habitat indicator are described, with the assessment including the segments of the Libby Creek, Fisher River, East Fork Bull River, and Rock Creek watersheds that are within the analysis area. Sufficient stream habitat data are available for many of the habitat indicators for the Libby Creek watershed, but are limited for the Fisher River, East Fork Bull River, Poorman Creek, and Rock Creek watersheds. Major assessments of the drainage occurred for the 1992 Montanore Project Final EIS in 1988 (Western Resource Development Corp. 1989a) and as an update of the 1992 Final EIS data in 2005 (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005a, 2005b, 2005d; Kline Environmental Research *et al.* 2005; Watershed Consulting and Kline Environmental Research 2005). Habitat surveys at a more limited number of sites also were conducted before and after the baseline surveys in 1988, as summarized by Kline Environmental Research (2004) and USDA Forest Service (2005).

#### *3.6.3.12.1 Temperature*

Riparian harvest and channelization (especially on Libby Creek) on National Forest System lands and other private lands along the mainstems of streams in the analysis area has occurred for mining, land development, and land management. Grazing occurs only on private property in the Libby Creek drainage. It is likely that there has been a noticeable change in temperature as a result of timber management and channelization on lands in the analysis area. Water temperature monitoring has occurred on both Libby Creek (two sites, upper and lower) and West Fisher Creek (at one site near the confluence with the Fisher River). Temperature data indicate that the lower and middle segments of Libby Creek and the lower segment of West Fisher Creek are warmer than 15°C, a maximum limit for salmonids, for numerous days during the summer months.

Temperature data collected during the 2005 field season in the Libby Creek watershed during baseline flow conditions by Kline (2005) ranged from 5°C to 19°C, with mean stream temperature at each site ranging from 9°C to 13°C in 2005. These data were from nine temperature loggers placed at sites L1, L10, Be2, LC1, LC3, Po1, Po2, Ra2, and Ra3 (Figure 53).

Temperature data also were collected in 1994 in the East Fork Bull River and Rock Creek. Temperatures averaged 6°C in the East Fork Bull River and 7°C in Rock Creek, and ranged from less than 1°C to 17°C in these streams (Washington Water Power Company 1996). Temperatures recorded in 2002 at the mouth of the East Fork Bull River had a maximum temperature of 15°C (Liermann and Tholl 2003).

Bull trout require water temperatures ranging from 2°C to 15°C, with temperatures at the low end of this range required for successful incubation (USFWS 1998). While based on limited data, the temperatures in most stream reaches were within this range for most of the year. Maximum water temperatures were occasionally above 15°C at the most downstream Libby Creek site and the East Fork Bull River site during the summer months. Temperatures occasionally exceed the maximum water temperatures for fish spawning and rearing in the analysis area (MMI 2006).

#### *3.6.3.12.2 Sediment*

Substrate composition is dominated by cobble and gravel in most surveyed sites in the analysis area (Watershed Consulting and Kline Environmental Research 2005). The mean percent fines (described in the report as fines less than 6.25 mm) in gravel at each site ranged from 14.6 percent at the lowest Libby Creek site to 43.0 percent at the Rock Creek site (Washington Water Power Company 1996; Wegner, pers. comm. 2006a) (Table 57).

Incubation of bull trout embryos begins to decrease substantially when more than 30 percent of the sediment is smaller than 6.35 mm in diameter. There is an inverse relationship between the percentage of fine sediment in the incubation habitat and survival until emergence (Weaver and Fraley 1991). Based on these data, sediment is not currently a limiting factor in most stream reaches within the Libby Creek drainage in the analysis area. Sediment may be more of a factor in Rock Creek, where sediment levels were described as being relatively high compared to other lower Clark Fork River tributaries (Kline Environmental Research and Watershed Consulting 2005b).

#### *3.6.3.12.3 Nutrients and Contaminants*

The Libby Creek reach from 1 mile upstream of the Howard Creek confluence to the U.S. 2 Bridge is included on Montana's 303(d) list for water quality impaired streams. Use as a drinking water supply is not supported as a beneficial use, and aquatic life support and cold-water fishery uses are only partially supported for this reach. Probable causes listed by the DEQ are alteration in stream-side or littoral vegetative covers, mercury exceedances, and physical substrate habitat alterations likely resulting from impacts from abandoned mine lands and placer mining. During the 1988-1989 monitoring period, mercury concentrations in surface water exceeded human health standards occasionally, but have generally been below detection limits in later sampling. Mean mercury concentrations in fish tissues analyzed from that same time period were below the EPA's water quality criteria for the protection of human health for methylmercury.

The Fisher River from the confluence of the Silver Butte Fisher River and the Pleasant Valley Fisher River to the confluence with the Kootenai River is included on Montana's 303(d) list, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Fisher River impairment are a high flow regime and high lead concentrations, with probable sources of these impairments listed as channelization, grazing, road runoff, road construction, silvicultural activities, and streambank modification and destabilization.

Rock Creek from the headwaters to the mouth below Noxon Dam is also listed, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Rock Creek impairment are other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities. TMDLs are not required on Rock Creek because no pollutant-related use impairment has been identified.

Existing surface water conditions for metals occasionally exceed the chronic ALS for cadmium, copper, lead and zinc at various locations throughout the watershed (Geomatrix 2007f). Metal concentrations in analysis area streams are variable. For example, about half of the surface water samples collected in Libby Creek had copper concentrations below the detection limit, with detected concentrations ranging above the chronic and acute ALS. The occasionally elevated concentrations suggest that existing concentrations of these metals may pose risks to aquatic life presently inhabiting these streams. The presence of diverse size classes of fish in the Libby Creek watershed streams suggests concentrations of these metals are not contributing to acute toxic effects for fish populations. It is not known whether chronic metal toxicity may be contributing to low population densities in these streams.

Generally, nutrient and most metal levels in analysis area streams are low. Nitrate/nitrite levels in Libby Creek downstream of the Libby Adit were elevated from 1991 through 1993, but concentrations declined after adit construction ceased.

#### *3.6.3.12.4 Physical Barriers*

Presently, man-made barriers, natural barriers, and small stream size of many tributaries limit bull trout distribution and connectivity in the Libby Creek watershed. A natural 39-foot waterfall on Libby Creek upstream of the Howard Creek confluence is an upstream barrier to all fish under all flow conditions. This barrier isolates the bull trout population upstream of these falls to a portion of the watershed. Natural barriers on Little Cherry Creek, Poorman Creek, and Ramsey Creek cause portions of these tributaries to be inaccessible to fish from Libby Creek (Kline Environmental Research 2005a). Little Cherry Creek provides the least amount of habitat for fish moving from Libby Creek because of the close proximity of natural barriers to the confluence of Little Cherry Creek and Libby Creek. Culverts may limit the passage of juvenile fish on Little Cherry Creek and Poorman Creek. For the most part, the connectivity and availability of bull trout habitat is not significantly limited by man-made barriers in the portion of the Libby Creek watershed within the analysis area.

No barriers have been described in the East Fork Bull River and the Fisher River, but no surveys specifically assessing fish passage were available. In West Fisher Creek drainage, the mouth of the stream has become extremely braided. There are numerous small side channels connecting the Fisher River with West Fisher Creek. These channels allow minimal passage for large migratory fish. These fish stack up in the Fisher River under the U.S. 2 Bridge and wait for months until rain brings enough water to open up access into the drainage. Barriers to upstream fish migration do exist on East Fork Rock Creek, but the barriers are located upstream in the Rock Creek Meadows reach and the outlet to Rock Lake. Additionally, these barriers do not prevent downstream fish movement (Washington Water Power Company 1996). Two reaches of Rock Creek near the mouth are subject to periodic dewatering, which act as a barrier to fish during low flow periods (FWP 2008a).

#### *3.6.3.12.5 Substrate*

The dominant substrate classes in the Libby Creek watershed are cobble and gravel (Watershed Consulting and Kline Environmental Research 2005). Substrate in the East Fork Bull River is primarily gravel and rubble, while the substrate in Rock Creek is predominately rubble, cobble, gravel, and boulder (Washington Water Power Company 1996). Substrate embeddedness in rearing areas has not been quantified in most of the analysis area. Embeddedness in Little Cherry Creek was low for most of the stream length, but high through a 1,000-foot reach about 3,300 feet upstream of the Libby Creek confluence (Kline Environmental Research 2005a).

#### *3.6.3.12.6 Large Woody Debris*

The number of pieces of LWD per mile ranged from 22 to 338 within the Libby Creek watershed (Watershed Consulting and Kline Environmental Research 2005). LWD was most abundant in Little Cherry Creek, but was found at densities higher than 105 LWD/mile at all sites except for four of the Libby Creek sites (Figure 53). Surveys indicated that adequate cover in the form of LWD was available for bull trout within the East Fork Bull River and Rock Creek watersheds. An average of 243 pieces of LWD/mile and 274 pieces of LWD/mile were counted in the Rock Creek and East Fork Bull River reaches surveyed (Washington Water Power Company 1996). Based on these data, the amount of large woody debris within the analysis area is sufficient to provide bull trout with adequate cover in most reaches. The RMO for LWD differs between stream size classes, but streams in the analysis area did meet the RMO for LWD, with the exception of one site on West Fisher Creek in 1996 (Table 58).

#### *3.6.3.12.7 Pool Frequency*

Most of the tributaries within the Libby Creek drainage had a fairly high number of pools, with the number per mile similar to values recommended by the USDA Forest Service (1998a) to provide sufficient bull trout habitat. The mainstems of Libby Creek and West Fisher Creek are generally lacking in pools. Most tributary streams seem to be mostly meeting the RMO, having adequate pools (USDA Forest Service 1995). With the past history of management in RHCAs, the high densities of road in the RHCA, and the large amounts of bedload transport in these streams, it is highly unlikely that many pools will be naturally generated in the mainstems of these drainages to satisfy this RMO. Pool generation in small streams is directly related to production of LWD in RHCAs. As trees fall into the stream, they modify streamflows in such a way that creates pools. The lack of LWD causes stream velocities to be faster and more direct, resulting in a lack of scoured pools. Although the RMO for LWD was met in many small streams, future production of LWD in RHCAs of larger streams will be limited due to the high densities of road and past timber harvest. Fine sediment will continue to be produced from timber management and roading in the drainages, which will continue to negatively impact pools.

#### *3.6.3.12.8 Pool Quality*

Quality pools are generally over 3 feet deep and have sufficient cover to hide fish. Measured pools during fisheries habitat surveys generally had adequate cover but lacked depth. Attempts to enhance pools in Libby Creek (mostly by FWP) have not been successful. Constructed pools were destroyed by high peak flows in the spring of 2007. The KNF constructed some pools and completed bank stabilization work on 3,800 feet on West Fisher Creek in 1997. The project is showing signs of stress from high flows and will need future work to further stabilize the area. High rain-on-snow events and active channel migration in these streams will continue to move large amounts of bedload and create channel widening. Loss of LWD and impacts from private

land will continue in the RHCAs of both drainages. As long as conditions do not change, this habitat characteristic will not meet RMOs.

The downstream Libby Creek site had the highest number of deep and large pools per mile of the analysis area streams. No other site had a significant number of deep pools (described as pools with a maximum depth greater than 5.2 feet), although large shallower pools (with depths greater than 2.6 feet and covering an area of greater than 215 square feet) were found on several Libby Creek sites, the Bear Creek site, and the two downstream Ramsey Creek sites (Watershed Consulting and Kline Environmental Research 2005). Some stream reaches within the analysis area may provide poor cover for bull trout due to the limited number of pools of sufficient depth and area. Pool quality data were not available for the East Fork Bull River, Rock Creek, or the Fisher River watersheds.

#### *3.6.3.12.9 Off-Channel Habitat*

Off channel habitat is found in side channels, tributary streams, and springs in the RHCAs of the mainstems of analysis area streams, and provides additional habitat for fish. The availability and type of habitat varies by stream in the analysis area. The analysis area supports classic mountain streams with moderate gradients and moderate entrenchment ratios. This changes to deeply incised boulder/bedrock-dominated streams in the headwaters and gentler gradient wider floodplains with low incision ratios in the lower segments of the larger streams. The analysis area contains almost every type of stream channel on the KNF. An extensive amount of off-channel habitat is found in the analysis area. The high densities of road in the RHCAs limit the streams' ability to make adjustments and create off-channel habitat, disrupting the long-term stability of this type of habitat.

Off-channel habitat is somewhat limited in some stream segments within the Libby Creek watershed. Several off-channel pools/backwaters were noted in Little Cherry Creek, primarily in the more upstream reaches (Kline Environmental Research 2005a). Multiple side channels were documented in Bear Creek during the 2005 survey, which could provide habitat for juvenile salmonid rearing (Watershed Consulting and Kline Environmental Research 2005). No other off-channel habitat has been documented in analysis area streams.

#### *3.6.3.12.10 Refugia/Prime Habitat*

Very few areas of high quality (prime) habitat are in the analysis area due to extensive riparian roading, past mining practices, and timber harvest in the lower portions of analysis area streams. Surveys have found that streams partially meet RMOs for pool quantity. Streams in the CMW portion of the analysis area are considered prime habitat. No timber management has occurred on these streams and human impacts are almost non-existent.

Only limited areas of diverse and high quality habitat exist over most of the analysis area in the Libby Creek watershed. Availability of habitat in the tributaries for fish moving from Libby Creek is limited by barriers, particularly in Little Cherry Creek (Kline Environmental Research 2005b). In 2002, the FWP completed stream restoration work on a segment of Libby Creek downstream of the Howard Creek confluence. The goal for this restoration project was to increase habitat quality for salmonids throughout this reach by increasing sinuosity, excavating depositional areas, and installing structures to increase bank protection, bank stabilization, gradient control, and pool habitat. The riparian vegetation was also restored (Dunnigan *et al.* 2003; Kline 2004).

A channel restoration project in East Fork Bull River was completed in 2001. Over 985 feet of the stream were restored by returning a braided channel to a single channel through the construction of rootwad and log revetments (logs anchored against the streambank to buffer stream energy), the placement of large woody debris weirs, and the revegetation of the streambanks and floodplain. The goal of this restoration was to make the channel more capable of transporting sediments and conveying bankfull flows (Avista Corp. 2007; FWP 2008a). The channel has migrated to the opposite bank, so this section is currently dry. Additional work has been completed upstream of this section which should reduce sediment in the lower reaches of the East Fork Bull River (Carlson, pers. comm. 2008).

#### *3.6.3.12.11 Pool Width/Depth Ratio*

Most measured pools on the lower segments of stream channels in the analysis area are shallow and wide. Pools measured in headwater reaches are narrow and deep. Pools in the mainstems of larger analysis area streams have high peak flows from spring runoff and rain-on-snow events. These high flows coupled with high bedload and the relatively wide floodplains make pool creation and maintenance extremely difficult. Based on the data collected in 2005 (Watershed Consulting and Kline Environmental Research 2005), the average wetted width to maximum depth ratio in scour pools within each reach in the Libby Creek watershed range from 6.5 to 11.2. All analysis area streams have ratios less than 10 except for Ramsey Creek, indicating that pools exist within the Libby Creek watershed in the analysis area of sufficient depth to provide refuge for larger migratory fish and rearing habitat for the young of year fish and sub-adults. For the Fisher River, reaches with pools present have ratios that range from 16.9 to 3.2, suggesting that some areas may not provide sufficient refuge for larger fish or rearing habitat for young of the year fish. These higher ratios are generally in the lower reaches of the Fisher River. Miller Creek had ratios under 10 except in the very lowest reach, indicating that pools exist within the Libby Creek watershed in the analysis area of sufficient depth to provide refuge for larger migratory fish and rearing habitat for the young of year fish and sub-adults.

#### *3.6.3.12.12 Streambank Conditions*

Stable stream banks have greater than 80 percent linear stability. Libby Ranger District surveys found bank stability to be very good in all streams in the analysis area. Some measured reaches showed unstable bank conditions, but overall, streams in the analysis area are in good shape. Stream bank vegetation tends to become disturbed and stream bank sediment is readily available to be deposited into the stream. Most streams are in good condition, although rain-on-snow events and high spring peak flows may destabilize banks. Larger streams in the analysis area show signs of high flows destabilizing banks, while smaller streams are more armored and have resisted bank instability.

Bank stability was described as high within all surveyed stream reaches in the Libby Creek watershed, ranging from 99 to 100 percent stable banks (Watershed Consulting and Kline Environmental Research 2005), and should not be a factor in limiting available trout habitat. Bank stability was also described as stable in Rock Creek and the East Fork Bull River (Washington Water Power Company 1996). Portions of Libby Creek and other analysis area streams have been cited as having accelerated bank erosion, altered riparian zones, and reduced high quality habitat for salmonids due to human-caused disturbances such as logging, mining, riparian road construction, and stream channel manipulation (Washington Water Power Company 1996; Dunnigan *et al.* 2004). Habitat restoration projects have focused on improving some of these segments.

### *3.6.3.12.13 Floodplain Connectivity*

Braiding is common throughout the mainstems of Libby Creek, West Fisher Creek, and Fisher River. Braiding occurs in streams with wide floodplains and large amounts of bedload. The bedload is moved during high flows, and can cause channels and associated wetlands to become disconnected from the main channel during low flows. Significant changes in riparian value and function due to channelization, land development, timber harvest, road construction, and mining, have contributed to destabilization of stream channels.

No specific data on floodplain connectivity were available for analysis area streams. Habitat surveys in the Libby Creek watershed stated that the channel capacity for most streams in the analysis area was inadequate or barely contained peak flows, with overbank flooding occurring occasionally or frequently (Kline Environmental Research 2004; USDA Forest Service 2005). Overbank flooding is considered necessary for maintaining wetland functions, riparian vegetation, and succession (USFWS 1998). Assessing floodplain connectivity in headwater mountain streams is complicated by the fact that they are usually restricted by a narrow, frequently incised mountain valley configuration and may not have a classic "floodplain."

### *3.6.3.12.14 Change in Peak/Base Flows*

Peak streamflows occur annually between April and June, with the highest flows most often occurring in May, then in April. Section 3.11.3.3.2, *Streamflow* discusses peak flow in analysis area streams. Typically, smaller, short-term increases in streamflow occur in October through March due to precipitation and snowmelt events. Libby Creek, Miller Creek, and West Fisher Creek have highly variable flow regimes, with flooding regularly occurring resulting in annually high suspended sediment levels, and high bedload movement. Since the turn of the century, timber harvest, road construction, mining, and human development have changed watershed character and, as a result, the watershed's response to weather events. Various stream reaches have become intermittent in nature due in part to the large depositions of bedload, channel braiding, and widening. While Libby, Miller, and West Fisher creeks naturally have high peak flows during spring snow melt and rain-on-snow events, past human activities, such as instream mining, timber management, and road construction in riparian areas, may intensify damage to these streams caused by peak flows. The range of measured minimum and maximum streamflows is provided in Table 84 in section 3.11, *Surface Water Hydrology*.

### *3.6.3.12.15 Increase in Drainage Network*

Drainage network is the network of streams within the watershed. There are no direct measurements of an increase in drainage network for analysis area streams. Human-caused disturbances such as logging, mining, riparian road construction, and stream channel manipulation have been cited as causing accelerated bank erosion, altered riparian zones, and reduced high quality habitat for salmonids within some segments of analysis area streams (Washington Water Power Company 1996; Dunnigan *et al.* 2004). These data indicate that there has likely been an increase in the drainage network within the analysis area. Road densities in the Libby Creek and West Fisher Creek drainages are considered high. Road failures have been a common occurrence throughout these drainages and their tributaries probably due to high precipitation events in the analysis area, rapid snowmelt and runoff from high elevation areas, and rain-on-snow events. Road and bridge failures have been an annual occurrence due in part to the volatile nature of these precipitation events. Sediment input due to road surface and ditch erosion is high. Road systems run parallel to or traverse every major tributary and the mainstems of Libby

Creek and West Fisher Creek. Many of these roads have been in place for decades, constructed to mining locations in the late 1800s and early 1900s.

#### *3.6.3.12.16 Road Network*

Roads and trails run parallel to most of the length of Libby Creek, Miller Creek, West Fisher Creek, East Fork Rock Creek, and their major tributaries. Many of these roads were constructed within the RHCAs. Some of these roads were originally constructed in the early 1900s to low standards and maintained infrequently. Impacts to streams associated with these roads include increased sedimentation, water routing down ditch lines, road stream crossing failures, hill side slumping, and removal of riparian vegetation due to road construction.

#### *3.6.3.12.17 Riparian Habitat Conservation Areas*

Timber harvest, mining, livestock grazing, road construction, and other human-caused disturbances have altered limited reaches of riparian zones in some areas of the Libby Creek, Rock Creek, East Fork Bull River, and Fisher River watersheds. Roads have been constructed within the RHCAs throughout the analysis area watersheds. RHCAs are shown in Figure 54.

#### *3.6.3.12.18 Disturbance History and Regime*

Disturbance regime refers to any natural disturbances that were present historically in the analysis area. Natural disturbance regimes are highly variable in analysis area drainages. Natural disturbance regimes include large fluctuations in runoff, such as rain-on-snow events and high peak flows during snow melt. Catastrophic disturbances are common, including flood events, high bedload movement and deposition, channel braiding, and mass wasting. The drainages are moderately prone to rain-on-snow floods. Windstorms resulting in blowdown have been minor and are generally associated with clearcutting activities. Although a large portion of the analysis area burned in 1889 and 1910, no major wildfires have occurred in several decades.

### 3.6.3.13 Integration of Species and Habitat Conditions

The quality of the bull trout habitat throughout the analysis area, especially in the larger tributaries, has been compromised by land development (particularly lower in the Libby Creek drainage), mining, and road construction in riparian areas along the mainstem of the streams. Disturbance over the past 10 to 20 years has included natural fires, large windstorms, 100-year flows and rain-on-snow events. Impacts to stream channels and fish habitat have increased and include mass wasting, road culvert and bridge blowouts, bedload deposition, channel aggradation (build up of bedload) and degradation (down cutting) and flooding. Data on bull trout are fairly limited because, until recently, the major emphasis was on eliminating bull trout from local streams. Bull trout were viewed by some as undesirable bull trout prey upon small species of desirable sport fish.

The bull trout population in the Libby Creek drainage within the analysis area is currently at risk from the threat of hybridization and competition with the non-native brook trout moving into the area. Areas of high quality trout habitat in the Libby Creek watershed are limited. Bull trout have been routinely observed within the analysis area, but they persist only at low densities.

Bull trout appear to be found in higher densities in the Rock Creek and East Fork Bull River drainages, but as with the Libby Creek population, they are at risk from hybridization and competition with brook trout. Brown trout are also present in the East Fork Bull River drainage, and while they present no risk of hybridization with bull trout, they can pose a risk to the bull

trout population through competition for resources. Non-native suppression has been initiated to lessen this threat (Moran and Storaasli 2008). Logging, grazing, and wildfires have affected significant portions of the riparian zones in these streams (Washington Water Power Company 1996). The Fisher River is a migratory corridor for populations of bull trout. West Fisher Creek is a priority watershed. Bull trout occur in the stream and are at risk from competition for resources. The two segments of designated critical habitat on West Fisher Creek have adequate habitat to support bull through these reaches (Table 58).

Redband trout habitat has been similarly influenced by past mining efforts and other disturbances, but the largest threat to the redband trout is hybridization with introduced rainbow trout and native westslope cutthroat trout. Based on results from genetic analyses conducted in 1991 through 2005 (FWP 2008a), most of the redband trout population within the Libby Creek watershed is at least slightly hybridized, with pure populations existing in small tributaries where barriers are thought to isolate them from mainstem populations. While they have been observed regularly within all the analysis area streams within the Libby Creek watershed, redband trout are found at relatively low densities.

Redband trout are not found in the Rock Creek or East Fork Bull River watersheds, but pure redband trout are found in the Fisher River drainage, including West Fisher Creek. As with the Libby Creek watershed, these fish are at risk from hybridization because the trout in the segment of the Fisher River downstream of the analysis area and in some of the tributaries are hybridized.

In the analysis area, westslope cutthroat trout are known to be present in the Rock Creek and East Fork Bull River watersheds and Miller Creek. In the Libby Creek drainage westslope cutthroat trout are hybridized. As with redband trout, they are mainly at risk from hybridization and competition with introduced trout species. In East Fork Rock Creek, hybridization with rainbow trout and Yellowstone cutthroat trout is occurring in the upstream reaches, and no barriers have been identified that would protect the remaining genetically pure trout from these trout moving downstream. While the most recent genetic analyses have indicated that the westslope cutthroat population in the East Fork Bull River is pure, no barriers to protect these trout from hybridization have been observed. Westslope cutthroat trout densities are higher in these watersheds than redband or bull trout densities, indicating that the westslope cutthroat trout population is less at risk of extirpation in these streams.

## 3.6.4 Environmental Consequences

### 3.6.4.1 Alternative 1 – No Mine

Under this alternative, MMC would not develop the Montanore Project. Any existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

Without mine development, aquatic populations and stream habitat would remain unchanged from existing conditions. Productivity of fish and other aquatic life in analysis area streams would continue to be limited by past natural and human-caused adverse habitat changes, by naturally

low nutrient concentrations, and by natural habitat limitations from climatic and geologic influences.

Bull trout populations would continue to be marginal and the habitat in need of restoration work. Bull trout populations would be susceptible to decline or disappearance due to hybridization with introduced salmonids, competition with brook trout and other trout present in the analysis area, or from land use disturbances. Redband trout and westslope cutthroat trout also would continue to be subject to population declines, mainly due to the threat of hybridization from introductions of non-native salmonids. Improvements in habitat quality and productivity due to natural processes over time would potentially be adversely affected by the cumulative effects of continued forestry activities. Past, current, and future placer mining, continued recreational use, and other reasonably foreseeable actions would continue to affect fish populations.

### 3.6.4.2 Alternative 2 – MMC's Proposed Mine

Development of the Montanore Project would require construction of project facilities, including a mill, tailings impoundment, adits, access roads, and transmission lines. For Alternative 2, MMC's proposal, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 mile from the CMW boundary. An additional existing adit on private land held by MMC in the upper Libby Creek drainage and an adit on MMC's private land east of Rock Lake would be used for ventilation. The proposed Rock Lake Ventilation Adit would be on a steep, rocky slope about 800 feet east of and 600 feet higher than Rock Lake. Because the total disturbance area for this adit would be small (about 1 acre), any effects would be minor and are not discussed further. A tailings impoundment would be constructed in the Little Cherry Creek drainage, and would require the diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek would be used for discharge of water through land application.

Potential impacts to fish and other aquatic life in the Libby Creek, Rock Creek, and East Fork Bull River drainages from the various proposed alternatives for the Montanore Project can be grouped under six general categories: changes in sediment delivery, changes in water quantity, changes in water quality (nutrient and toxic metals levels), changes in toxic metal concentrations in fish tissues, effects on fish passage, and effects on threatened, endangered or sensitive species. These effects will be addressed individually for each alternative.

#### *3.6.4.2.1 Sediment*

**Construction and Operation of Mine**

*Streams*

Possible sediment sources would include new road construction, road maintenance, sanding, and plowing, facilities construction, transmission line construction, existing road upgrades, timber and vegetation clearing, soil stripping, construction and use of the diversion and drainage channels for the tailings impoundment, excavation of borrow areas, stockpiling of excavated soils, and tree thinning in LAD Areas. The highest risk of increased sediment would occur during the construction phase of the mine, when trees, vegetation, and/or soils were removed from many locations for mine facilities and roads.

Any potential sediment increase from Alternative 2 would only affect analysis area streams within the Libby Creek watershed. No surface disturbances other than the ventilation adit in the

Rock Creek drainage would occur in the Rock Creek or East Fork Bull River drainages. Ventilation adit construction would not generate significant sediment.

Periodic short-term increases in the amount of sediment would occur in streams in the Libby Creek watershed. Several structures are planned to reduce or eliminate sedimentation increases to meet the INFS riparian goal. INFS designates that the integrity of the sediment regime of the riparian and aquatic ecosystems should be maintained. Based on the use of BMPs and other design criteria, sediment increases would have minimal effects on analysis area streams under most conditions.

The plant facilities, adits, and tailings impoundment would contain features that route all water and sediment to sediment traps or ponds designed to hold runoff flows from a 10-year/24-hour storm event. In the case of larger storms, overflows from these sediment ponds would be directed into Ramsey and Poorman creeks, and would cause short-term increases in sediment in these creeks. The high streamflows present during such an event would likely distribute much of the sediment well downstream to be deposited in floodplains or low gradient stream reaches, or transported to the Kootenai River. Any sediment flushed out of the Libby Creek watershed into the Kootenai River would settle out rapidly and would have negligible effect on aquatic resources or habitat.

Tree thinning is planned within the LAD Areas to allow for effective use of the sprinkler system. Clearing prior to construction and resulting road construction usually results in an increase in the amount of sediment delivered to streams. All clearing prior to construction at the LAD Areas would be located 300 feet or more from Poorman and Ramsey creeks. At MMC's proposed application rates, the agencies' analysis shows that surface runoff would occur (see section 3.10.4, *Environmental Consequences*). MMC indicated that sprinklers within 100 feet of ephemeral streams would be shut off during periods of surface water runoff and MMC would not be allowed to operate the LAD Areas in a manner that produces runoff or increases in spring flow. With these measures in place, minimal increases in sediment directly to Poorman or Ramsey creeks from tree thinning are predicted.

The Little Cherry Creek Diversion Channel would be designed to convey the 6-hour Probable Maximum Flood flows, while the riprap that lined the channel sides would be designed for the 100-year flood flows. While these measures would minimize erosion, some increased sedimentation in the unnamed tributary and Libby Creek is expected. If substantial erosion were observed once the diversion channel was operational, additional erosion structures would be constructed as needed. Borrow areas within the diversion dam disturbance area also would serve as sources of sediment to streams. Collection ditches/berms would be installed around soil stockpiles to reduce soil erosion and loss, and to limit any sedimentation impacts. Additionally, interim and concurrent reclamation would be employed where possible in all areas to reduce sediment loading and enhance site stability.

New road and bridge construction would be required in some areas within the Libby Creek watershed, and other roads would be reconstructed. Road construction and reconstruction is often considered the largest source of sediment in mining and timber harvest areas due to the removal of vegetation and construction of cut and fill slopes that expose large areas subject to erosion (Belt *et al.* 1992). BMPs would be used during road construction to reduce the amount of sediment reaching streams. Although BMPs and other erosion control methods would be used, roads would still serve as a source of sediment (Belt *et al.* 1992). Some sedimentation from road

construction and reconstruction would be likely, with the most increases occurring at stream crossings in Ramsey Creek, Poorman Creek, Bear Creek, and Libby Creek.

Alternative 2 would disturb 253 acres within RHCAs on National Forest System lands; 148 acres of other riparian areas on private lands would be disturbed (Table 63). Roads would be constructed or reconstructed within the RHCAs of Little Cherry, Libby, Bear, Poorman, and Ramsey creeks, as well as unnamed tributaries. Most of the roads reconstructed are existing roads that cross a RHCA only at a stream crossing, but segments of existing roads parallel the RHCAs along Ramsey and Libby creeks. Adverse direct effects to fish habitat would occur where roads were constructed in RHCAs and particularly where roads crossed streams into which sediment would be directly routed. Sedimentation would decrease pool habitat, decrease spawning habitat, and increase direct chronic stress to salmonid populations. Any new or altered culverts and bridges at stream crossings would be designed to avoid streamflow constriction and streambed scouring. New bridges that would cross Poorman Creek and Ramsey Creek are proposed. Portions of LAD Area 2, the tailings impoundment, the Ramsey Plant Site, and the Libby Adit also would be within RHCAs or riparian areas on private land. Where roads and other mine facilities would be within RHCAs, design features and BMPs would be used to minimize additional sedimentation (MMI 2006).

**Table 63. RHCAs and Other Riparian Areas within Mine Disturbance Areas.**

| Type of Riparian Area | Alternative 2 – MMC's Proposed Mine | Alternative 3 – Agency Mitigated Poorman Impoundment Alternative | Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative |
|---|---|---|---|
| RHCAs on National Forest System lands | 253 | 158 | 206 |
| Other riparian areas on private lands | 148 | 9 | 143 |
| Total | 401 | 168 | 349 |

All units are acres.
RHCAs are found only on National Forest System lands.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Because of the inability to reliably quantify potential sediment increases in the Libby Creek watershed, predicting the effects on aquatic life is difficult. Increased sediment in streams would alter stream habitat by decreasing pool depth, alter substrate composition by filling in interstitial spaces used by juvenile fish and invertebrates, and increase substrate embeddedness (Rieman and McIntyre 1993; Waters 1995). These habitat alterations would adversely affect invertebrate and fish populations within the streams.

As embeddedness increases and larger substrates such as gravel and cobble are replaced by sand and silt, the available high quality habitat for many macroinvertebrate taxa decreases, often resulting in a decrease in macroinvertebrate abundance and biomass. Additionally, increased sedimentation can result in changes in the composition of the macroinvertebrate population, with more sensitive taxa, such as the EPTs, replaced by small, burrowing invertebrates such as chironomids and oligochaetes. While these taxa may be abundant, the total biomass is often

reduced, and their habitat preferences make them less available as food for fish. A reduction in macroinvertebrate abundance or changes in the composition of the macroinvertebrate population can indirectly have deleterious effects on fish populations by causing slower growth rates, higher mortality, and reduced fecundity (Berkman and Rabeni 1987; Waters 1995; USFWS 2003).

Reduced food availability is not the only mechanism through which increased sedimentation can affect fish populations. The reduced pool depths that occur with heavy sedimentation diminishes the cover and available habitat for juvenile and adult fish, particularly during periods when water temperatures are high (Waters 1995). Additionally, increased sedimentation can directly affect salmonid reproductive success by degrading and decreasing spawning and rearing habitat, and by increasing egg and juvenile mortality (Shepard *et al.* 1984; Fraley and Shepard 1989; Waters 1995; Montana Bull Trout Scientific Group 1998). Fry emergence success has been documented as decreasing substantially in westslope cutthroat trout and rainbow trout as fine sediments increased (Weaver and Fraley 1993; Bjornn *et al.* 1998). Optimal bull trout spawning and rearing areas should have less than 20 percent surface fines of 6 mm or less for the habitat to be functioning appropriately (USFWS 1998). Less than 30 percent fines (<6.35 mm) are necessary for successful bull trout incubation (Parametrix 2005). An inverse relationship between bull trout densities and the amount of fine sediment present (Watson and Hillman 1997), and between the percentage of fine sediment in the incubation habitat and survival until emergence (Weaver and Fraley 1991) have been reported.

The existing levels of fine sediment in spawning areas in analysis area streams within the Libby Creek watershed in 2005 and 2006 ranged from 14.6 to 39.4 percent fines (< 6.25 mm) (Kline Environmental Research and Watershed Consulting 2005b; Wegner, pers. comm. 2006a), with most stream reaches having levels below the 30 percent fine sediment threshold (Parametrix 2005), which begins to substantially decrease successful bull trout incubation. One upstream site on Little Cherry Creek was above this threshold, with the percent fine sediment reaching almost 40 percent, while a reach on Libby Creek upstream of the Howard Creek confluence also approached this threshold (Table 57).

The abundance of fine sediment does not currently appear to be a limiting factor to trout populations occupying most stream reaches within the Libby Creek watershed. Competition and interbreeding with brook trout and competition with other trout species is one of the larger threats to bull trout in the Libby Creek drainage. Brook trout may be more successful than native trout in degraded areas, including areas where fine sediment levels are increased (Montana Bull Trout Scientific Group 1998; Shepard 2004). Slight increases in sediment in Libby Creek may provide a competitive advantage to brook trout over bull trout. The introduction of small amounts of additional small gravels and fine sediment from construction or operation of the mine would likely have few if any effects on macroinvertebrate and fish populations, and these effects would be short-term because annual snowmelt runoff would flush most accumulated fine sediments downstream. Rieman and McIntyre (1993) advise that any increase in the proportion of fines in substrates should be considered a risk to stream productivity and bull trout populations.

The probability of catastrophic failure of the tailings or sediment ponds is low, and estimating the probability, magnitude, or long-term effects of such events are difficult. A failure modes effects analysis completed for the Little Cherry Creek impoundment estimated the risk of catastrophic failure as having a 0.1 to 1 percent chance of occurrence (Klohn Crippen 2005). If such a failure occurred, the greatest effect would occur from large masses of sediment, as well as metals in the case of tailings impoundment failure, that would enter into the stream channel and cause

substantial alterations in the habitat of analysis area streams. These alterations could in turn cause extensive adverse impacts to bull trout populations and other aquatic life. Portions of this sediment mass likely would remain within the Libby Creek channel for an undefined period following the failure, while the rest would be carried downstream out of the Libby Creek system. The amount of sediment transported into the system would depend on the volume of water associated with the failure, and the initial volume and character of the sediments. Subsequent to any such failure, normal high-volume seasonal flushing flows would continue to wash most of the remaining sediment downstream, out of the Libby Creek system, and into the Kootenai River. Consequently, most fine sediments from any such catastrophic failure would not be expected to persist within Libby Creek more than a few years. Typically, following catastrophic events and depending on season, algae populations begin natural recolonization of affected stream reaches within a few days, larger plants within a few weeks, and many aquatic invertebrates within a few months to a year. Depending on the amount of sediment deposited in the streambeds, fish populations would naturally return to former population numbers within a few years.

As part of Alternative 2, one of the possible fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If implemented, this project would minimize the contribution of additional sediment to the Libby Creek watershed. Sediment (as percent fines) would be monitored within the Libby Creek drainage to detect any potential sediment increases. Sediment sampling would occur at a station on Libby Creek downstream of the Little Cherry Creek confluence. Sampling would occur daily during the construction phase, as most potential increases in sedimentation would be expected to occur then. During initial mine operations, sampling would occur on alternate days, and frequency would then be reduced to once per week for the remainder of the operations and reclamation phases. Based on the sampling schedule, any increases in sediment within the Libby Creek system would be detected quickly, allowing for prompt action or remediation.

*Lakes*

No sediment increases are projected for analysis area lakes during construction or operation of the mine. No mine activities would be located sufficiently near any of the lakes to cause sedimentation increases.

**Post-Mine Operations**

*Streams*

The potential for substantial increased sedimentation in streams after the completion of mining would be small and the effects on aquatic habitat and populations would be minimal in most analysis area streams after mine closure and reclamation. MMC would remove facility structures and reslope and revegetate disturbed areas. Revegetation practices would substantially limit erosion by providing a stabilizing cover, and interim stabilizing measures (BMPs) would be used until vegetation has been established.

The Little Cherry Creek tailings impoundment is expected to be reclaimed incrementally to minimize potential long-term erosion and maximize tailings dam stability. Surface runoff from the tailings impoundment would be directed toward Bear Creek, and would likely cause some increases in stream sedimentation during construction of the check dam and diversion channel. Stream sedimentation would have a short-term adverse effect on fish populations due to increased

sediment in the water column. An increase in fine sediment would alter substrate composition and increase substrate embeddedness, as previously discussed. These increases would be temporary, with most of the sediment flushed out of the system during high flow events, such as during snowmelt runoff or rain-on-snow events.

*Lakes*

No sediment increases are projected for analysis area lakes after the completion of mining. No mine activities would be located near any of the lakes.

#### *3.6.4.2.2 Water Quantity*

**Mine Construction and Operations**

*Streams*

***Libby Creek.*** Sections 3.10.4.2.1, *Mine Area* and 3.11.4.2.1, *Effects of Inflows During Construction and Mining* provide a discussion of the predicted changes in streamflow that would occur as a result of mine and adit inflows. Mine facilities would alter flow in Libby Creek and its tributaries through mine and adit inflows, diversions, discharges, and make-up ground water wells. Make-up water wells would be necessary if mine and adit inflows were not sufficient for mill operations. Changes in flow would likely not be measurable during high flow periods between April and July. If make-up ground water wells operated along Libby Creek during the November through March, average flow in Libby Creek below Little Cherry Creek would likely be reduced by up to 6 percent, depending on the amount of mine inflows (Table 90). Percent changes in flow would be greater during lower flow periods and less in higher flow periods. The inherent difficulties in accurately measuring low flows and the natural variability in low winter flow make the determination of impacts to fish habitat very difficult, but the decrease in streamflow would decrease available salmonid habitat.

***Ramsey Creek.*** The effect of base flow changes in Ramsey Creek would be similar to Libby Creek. Small decreases in flow in the headwater portion of Ramsey Creek may adversely affect fish habitat. Wastewater discharges at the LAD Areas would percolate to ground water, flow to Ramsey Creek, and partially offset the base flow decreases downstream of the LAD Areas while in operation.

***Poorman Creek.*** In Alternative 2, no flow-related habitat effects resulting from mine and adit inflows are predicted to occur in the Poorman Creek drainage. Lower Poorman Creek may gain flow when the LAD Areas operate. Other potential flow increases may result due to percolation from the unlined LAD Area stormwater retention pond to Poorman Creek. Although fish habitat would probably not change from such small additions, any changes in fish habitat would be indistinguishable from natural variation in the streamflow.

***Little Cherry Creek***. Alternative 2 would adversely affect fish habitat in Little Cherry Creek, with the construction of the tailings impoundment and Diversion Channel. The impoundment would result in the loss of about 13,000 feet of fish habitat in the existing Little Cherry Creek, from the Diversion Dam to the mouth of the former Little Cherry Creek. A small resident redband trout population currently exists in the stream. In the lower segment of Little Cherry Creek, the stream channel transitions through a steep gradient zone consisting of bedrock outcrops, and creates an impassable barrier to migrating bull trout. Although physical barriers have prevented the migration of bull trout into Little Cherry Creek, available fish habitat is suitable for bull trout.

Alternative 2 would result in an irreversible loss of genetic diversity from the redband trout found in Little Cherry Creek if proposed efforts to collect and transfer fish from the affected segment of Little Cherry Creek to the diversion drainage were not entirely successful. Additionally, the loss of habitat in Little Cherry Creek would result in a decrease in redband populations in Little Cherry Creek with Alternatives 2 and 4. Hybridization of the pure redband trout population in Little Cherry Creek may occur in Alternative 2 if barriers did not develop in the diversion drainage as predicted and the redbands came in contact with non-native trout in the Libby Creek drainage.

Flow from the headwater reaches of Little Cherry Creek would be diverted around the tailings impoundment via a constructed diversion channel and flow into two unnamed tributaries to Libby Creek. The unnamed tributaries are intermittent streams that only flow during spring runoff and storm events. Although annual flows in these channels would increase compared to existing flows, total annual flows in both channels combined during operations would be about 60 percent of the annual flows currently at the mouth of Little Cherry Creek (see section 3.11.4.3.5, *Effects of Diversions during Construction and Mining* in section 3.11, *Surface Water Hydrology*). The agencies' analysis assumed the engineered Diversion Channel would not provide any fish habitat, while the two channels (Channels A and B) would eventually provide marginal fish habitat for either redband trout or bull trout.

***Bear Creek.*** In Alternative 2, during operations when the Main Dam reached final crest height, the watershed of Bear Creek would be reduced by 8 acres because runoff from the dam would be collected by a diversion ditch at the toe of the Main Dam (see section 3.11.4, *Environmental Consequences*). The change in streamflow would be immeasurable and would not affect aquatic habitat.

***East Fork Rock Creek.*** The agencies' numerical model predicts that the base flow of East Fork Rock Creek would be reduced due to mine and adit inflows. These flow changes would affect the aquatic habitat in the high gradient reach of East Fork Rock Creek between Rock Lake and Rock Creek Meadows, a distance of about 0.75 mile. Trout habitat may be reduced during low flows from August to April. This habitat loss would be detrimental to the resident westslope cutthroat trout populations in the higher elevations of East Fork Rock Creek. Changes in flow downstream from Rock Creek Meadows would not likely be measurable, but would contribute to the dewatered sections of lower Rock Creek.

***East Fork Bull River.*** In Alternative 2, similar to East Fork Rock Creek, the agencies' numerical model predicts that the base flow of East Fork Bull River would be reduced due to mine and adit inflows. These flow changes would affect aquatic habitat in the river, which begins about 1.3 miles into the CMW. Changes in flow in the East Fork Bull River below St. Paul Lake due to mine operations may be difficult to separate from the natural variability of low streamflows. Decreased base flow in the upper river may result in habitat loss and adversely affect the adfluvial bull trout population that spawns in this stream.

*Lakes*

***Rock Lake.*** Because deep bedrock ground water is a contributor to Rock Lake throughout the year, mining may affect the level of Rock Lake. The agencies' ground water model predicts a decrease in ground water inflow to Rock Lake. This may result in measurable changes in lake level during periods when deep ground water provides the only source of water to the lake (*i.e.*, when there is no snowpack above the lake and no precipitation in the watershed above the lake).

Reduced water levels in Rock Lake may decrease available habitat for cutthroat trout present in Rock Lake.

***St. Paul Lake.*** St. Paul Lake has widely fluctuating water levels and is maintained through stocking of westslope cutthroat trout every 3 years. Any effect on aquatic life from changes in base flow would be minimal.

**Post-mine Operation**

*Streams*

***Libby Creek.*** Post-mining, it is predicted that a slight increase in streamflow would occur in upper Libby Creek, while a slight decrease in streamflow would occur beyond Libby Adit to the confluence of Bear Creek. A slight decrease in streamflow in Libby Creek may decrease available habitat during low flow periods, adversely affecting salmonids in the stream. During the post-mining period, tailings water would continue to be discharged at the LAD Areas. Discharges at the LAD Areas would percolate to ground water and flow into area streams, increasing Libby Creek streamflows. This additional flow in Libby Creek below the LAD Areas would partially offset reduced base flow in lower Libby Creek. Aquatic habitat would not be affected while discharges continue.

***Ramsey Creek.*** Base flows are predicted to increase slightly in Ramsey Creek post-mining, but the flow increases are likely to be immeasurable. Like Libby Creek, the lower elevation reach of Ramsey Creek would continue to receive additional flows via percolation from the LAD Areas. The base flow increases would benefit fish habitat in Ramsey Creek.

***Poorman Creek.*** The lower elevation reaches of Poorman Creek could continue to receive additional flows via percolation from the LAD Areas while the seepage collection system is operating. The flow increases would benefit fish habitat. After wastewater discharges at the LAD Areas cease, aquatic habitat in Poorman Creek would return to pre-mine conditions.

***Little Cherry Creek.*** The tailings impoundment and Diversion Channel on Little Cherry Creek would remain in place. Flow in the diverted Little Cherry Creek channel would be about one-half the flow in the original channel. Only marginal fisheries habitat would be available for potentially viable fish populations. Seepage would continue to occur from the tailings impoundment, which would be captured and recycled to the impoundment or discharged at the LAD Areas until water quality standards were met.

The watershed area of the former (original) Little Cherry Creek channel would be about one-fourth of the original watershed area. Streamflow would consist of runoff from the impoundment dam face and the remaining watershed area below the Seepage Collection Dam. Any surface water flow below the tailings impoundment entering the former lower Little Cherry Creek channel would not support a viable fish population. Runoff from the impoundment surface would be directed toward Bear Creek.

***Bear Creek.*** Post-mining, runoff from the tailings impoundment would be directed toward Bear Creek via a riprapped channel. A small rockfill check dam would be located just beyond the northwest end of the reclaimed impoundment. The check dam would be designed for the 100-year flood event. Short-term erosion in the ditch and subsequent sedimentation in Bear Creek would occur during construction of the ditch and check dam. This would result in short-term loss of food resources (such as macroinvertebrate drift with sedimentation and covering of substrate) and

short-term chronic effects to the fish (such as avoidance and reduced feeding). Where runoff flows into Bear Creek, the Bear Creek watershed area would increase by an estimated 8 percent (Appendix H). The projected increase in average annual flow of 4 to 5 percent would benefit fish habitat in Bear Creek. The larger watershed would increase runoff during stormwater runoff and would not affect base flows.

***East Fork Rock Creek.*** Post-mining, the agencies' numerical model predicts that base flow in East Fork Rock Creek would continue to be slightly less than pre-mining flow conditions. The predicted flow changes would be within the range of natural variability for this stream and would not affect fish or fish habitat.

***East Fork Bull River.*** Base flows during the post-mining period are predicted to increase slightly compared to pre-mining conditions in the East Fork Bull River drainage. Additional flows would benefit fish habitat, although any base flow-related habitat changes would be difficult to separate from natural variability.

*Lakes*

***Rock Lake.*** Post-mining, after the mine void became filled with ground water, base flow into Rock Lake is predicted by the agencies' numerical model to be less than pre-mining conditions, but more than during operations. It is predicted that it would take up to 70 years for the ground water level to return to pre-mining conditions. Aquatic habitat changes would be difficult to separate from those caused by natural variability in lake levels.

***St. Paul Lake.*** Post-mining, after ground water levels return to pre-mining conditions (up to 70 years), the numerical model predicted that ground water from the filled mine void may flow toward the East Fork Bull River drainage. St. Paul Lake may have slightly higher water levels than pre-mine and mining conditions, but base flow-related habitat changes would be difficult to separate from those caused by natural variability in lake levels.

#### *3.6.4.2.3 Water Quality-Nutrients*

Only minor differences in nutrient concentrations are expected during the three phases of mining operations; therefore, predicted impacts are discussed collectively rather than divided into construction, operation, and post-operation phases. Additionally, no changes in nutrient concentrations within the Rock Creek and East Fork Bull River drainages are predicted to occur with any of the alternatives, as surface disturbance near these streams is limited to the construction of the Rock Lake Ventilation Adit. These streams are not discussed further with regard to effects of changing nutrient concentrations.

**Construction, Operation, and Post-Operation of Mine**

*Streams*

The surface waters of the Libby Creek drainage have extremely low concentrations for most dissolved nutrients (Table 96 and Table 97). The low nutrient concentrations contribute to limited aquatic productivity. Mass balance calculations estimate a substantial increase over background nitrogen (nitrate and ammonia) concentrations in Ramsey, Poorman, and Libby creeks from the LAD Areas during periods of low flow (Table 101). These calculations assume no treatment in addition to land application.

If the TIN concentration in Libby Creek surface water increased to the nondegradation limit of 1 mg/L set in the BHES Order, the ER for TIN concentrations would be 6.7 to 10 in Ramsey, Poorman, and Libby creeks (Table 64). The TIN concentration would be relatively low. A TIN concentration of 1 mg/L may cause an increase in algal growth in Libby Creek, but algal growth would more likely be limited by factors other than nitrogen (*i.e.*, phosphorus, temperature, and light). Increased algal growth would stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Although the projected TIN concentration would be greater than existing conditions, the ammonia component of TIN would remain well below the applicable ammonia ALS (Table 64), indicating no potential toxicity from increased ammonia concentrations.

**Table 64. Projected Changes in Total Inorganic Nitrogen, Alternative 2.**

| Condition | Units | RA-600 | PM-1000 | LB-1000 |
|---|---|---|---|---|
| Ammonia Chronic ALS† | mg/L | 6.44 | 6.29 | 5.67 |
| Ecoregion Reference TIN‡ | mg/L | 0.2 | 0.2 | 0.2 |
| Existing Surface Water Conditions§ | | | | |
| pH | s.u. | 6.7 | 6.8 | 7.1 |
| Ammonia | mg/L | <0.05 | <0.10 | <0.05 |
| Nitrate | mg/L | <0.06 | 0.05 | 0.05 |
| Estimated TIN | mg/L | <0.11 | <0.15 | <0.10 |
| Potential TIN | mg/L | 1 | 1 | 1 |
| Enrichment Ratio | | 9.1 | 6.7 | 10 |

mg/L = milligram per liter; s.u. = standard units.
Projected changes assume TIN increases up to the BHES Order nondegradation limit of 1.0 mg/L.
†Ammonia chronic ALS value is pH and temperature dependent. Temperature was assumed to be 0°C.
‡25th percentile of reported total nitrogen for nutrient ecoregion II, level III subecoregion 15 (Environmental Protection Agency 2000).
§Median concentrations in analysis area streams are presented in Table 96 and Table 97.

*Lakes*

The contribution of regional ground water to Rock and St. Paul lakes may be reduced as a result of mining, resulting in the lake becoming more concentrated, with higher dissolved mineral concentrations. Estimated nutrient concentrations in ground water during construction, operations, and post-operation of the mine are expected to be low. As a result, lake nutrient concentrations are likely to stay very low; therefore, no effects to aquatic life are anticipated.

### *3.6.4.2.4 Water Quality-Metals*

Only minor differences in effects from metals concentrations would be expected during the three phases of operation; therefore, predicted impacts are discussed collectively rather than divided into construction, operation, and post-operation phases. The only exception may be the East Fork Bull River. About 70 years post-mining, water levels overlying the mine void would reach steady state conditions. The agencies' numerical model predicts that ground water in the mine void has the potential to flow toward the East Fork Bull River drainage. The predicted concentrations of metals in the mine void ground water would be relatively low. Should ground water flow from the filled mine void about 3,000 feet vertically through fractures to the East Fork Bull River,

attenuation of the dissolved metals and dilution would likely reduce metal concentrations. The fate and transport of dissolved metals within the flooded mine void cannot be predicted with certainty, particularly when compared to the relatively low surface water standards. Therefore, effects on aquatic biota cannot be estimated with any degree of certainty.

Additionally, no changes in metals concentrations within the Rock Creek drainage are predicted to occur with any of the alternatives because surface disturbance near this stream would be limited to the construction of the Rock Lake Ventilation Adit. This stream is not discussed further with regard to effects of changing metals concentrations.

### Construction, Operation, and Post-Operation of Mine

#### *Streams*

Table 101 provides the projected concentrations of various parameters for streams affected by discharges of wastewater. Concentrations of manganese are projected to increase above existing conditions during post-mining operations. As discussed previously, increased manganese concentrations are not expected to affect aquatic life. Concentrations of other metals are not projected to increase.

The BHES Order would allow total copper concentrations up to 0.003 mg/L in all surface waters affected by the project (BHES 1992). About half the surface water samples from Libby Creek had copper concentrations below the detection limit, 15 percent were greater than 0.003 mg/L, and the remaining samples were 0.003 mg/L or less (Table 65). The ER for copper may increase up to a factor of 3 or more, depending on the actual concentration of copper in samples below detection limit values, and the actual instream copper concentration after discharge of wastewater. Potential effects to aquatic life from an increase in copper concentrations are difficult to determine given recent uncertainties regarding the protectiveness of the hardness-modified copper standard and existing instream copper concentrations. Since the 1996 release of hardness-modified copper criteria recommendations (EPA 1996), additional research has shown that water quality parameters other than hardness and ionic composition affect copper toxicity. In 2007, the EPA released new water quality recommendations for copper toxicity using the biotic ligand model (BLM). The BLM uses multiple water quality parameters when determining the appropriate copper standard (EPA 2007). The detailed water chemistry data needed for BLM predictions are not available for the Libby Creek watershed. Preliminary analysis with the BLM indicates dissolved organic carbon and pH can be the primary drivers that influence copper toxicity (HydroQual, Inc. 2008). Typical ground water and snowmelt-fed mountain streams would be expected to have low dissolved organic carbon concentrations that make dissolved copper bioavailable and potentially toxic. Predicted increased nitrogen concentrations may increase primary productivity and likely increase dissolved organic carbon concentrations, which may offset potential toxic responses due to increased copper concentrations. Furthermore, measured instream copper concentrations are either at or near minimum laboratory detection limits, creating some uncertainty with any change in concentration from existing conditions.

The low concentrations of dissolved minerals in surface waters of the Libby Creek drainage cause these waters to tend toward acidic pH levels, and to have extreme sensitivities to fluctuations in acidity. For most heavy metals, the percentage of the metal occurring in the dissolved form increases with increasing acidity. Generally, dissolved metals are the most bioavailable fraction and have the greatest potential toxicities and effects on fish and other aquatic organisms. Any increase in metal concentrations could increase the potential risk for future impacts to fish and

other aquatic life in some reaches. Metal concentrations near the ALS could result in physiological stress, such as respiratory and ion-regulatory stress, and mortality. Specifically, effects of zinc concentrations at the BHES Order limit may cause decreased growth rates in aquatic insects and avoidance in salmonids (Eisler 2000). These zinc concentrations combined with the low percentage of samples above ALS (Table 65) would not substantially affect the aquatic biota.

**Table 65. Summary of Copper and Zinc Concentrations in Surface Water Samples from Libby Creek.**

| Metal | Chronic ALS | Number of Samples | Number of Samples Below Detection Limit | Number of Samples greater than Chronic ALS | Number of Samples with Detections less than Chronic ALS |
|---|---|---|---|---|---|
| Copper | 0.00285 | 229 | 109 | 32 | 88 |
| Zinc | 0.037 | 229 | 173 | 19 | 37 |

ALS = Aquatic life standard.
Source: Analysis by ERO Resources Corp. using data from Geomatrix 2007f.

Predicting potential impacts to fish and other aquatic life in the Libby Creek watershed is significantly complicated by the fact that the very low hardness and total alkalinity occurring in these waters naturally cause potential ion-regulatory difficulties and stress in fish. These problems are exacerbated by the low nutrient and productivity levels in the streams that permit only minimal production of food organisms for fish, causing additional stress to fish and other aquatic life.

Catastrophic failure of the tailings impoundment would release tailings with elevated metal concentrations into the diverted Little Cherry Creek and Libby Creek. The effects were discussed in section 3.6.4.2.1, *Sediment.*

*Lakes*

As a result of mining, Rock and St. Paul lakes may have higher dissolved mineral concentrations, which may decrease algal and macroinvertebrate production in both lakes, and potentially reduce the fishery of Rock Lake.

### *3.6.4.2.5 Toxic Metals in Fish*

Any increased metal concentrations in surface water would increase metal concentrations in fish. MMC has committed to treating water prior to discharge, if necessary, to meet water quality standards or BHES Order limits. With LAD or other treatment, the risk of increased metal concentrations in fish would be low. The flow in former lower Little Cherry Creek would not be sufficient to support fish. No changes in metal concentrations within the Rock Creek drainage are predicted with any of the alternatives because surface disturbance near this streams is limited to the construction of the Rock Lake Ventilation Adit.

##### *3.6.4.2.6 Fish Passage and Fish Loss*

**Construction and Operation of Mine**

*Streams*

Proposed road reconstruction between U.S. 2 and the Ramsey Plant Site would include stream crossing upgrades on Little Cherry, Ramsey, and Poorman creeks. Bridge construction to meet INFS standards, along with implementation of MMC's proposed BMPs, would minimize effects to fish passage. Based on these measures, no additional barriers to fish passage from stream crossings would be created in Alternative 2.

No additional stream crossings are proposed in the Rock Creek and East Fork Bull River drainages; therefore, no effects to fish passage from road or bridge construction would be expected to occur. Decreased base flows predicted to occur in the upper Rock Creek and East Fork Bull River drainages, mainly during operation of the mine, may reduce available bull trout and westslope cutthroat trout habitat and fish passage. The reduction in habitat may affect bull trout more severely than westslope cutthroat trout because they spawn during low flow times of the year from August through November. Additionally, dewatered reaches of Rock Creek have been observed during low flow time periods under existing conditions, and these reaches might remain dewatered for longer time periods and/or the length of stream dewatered may increase. Because these reaches are near the mouth of Rock Creek, they may further reduce migratory bull trout from accessing any significant portion of the Rock Creek drainage for spawning. The bull trout population in Rock Creek is thought to be composed primarily of resident fish, but migrant bull trout also have been observed. To some extent, the dewatered reaches may be protecting the resident bull trout population in Rock Creek from hybridization or competition with non-native fish by limiting non-native fish access to Rock Creek from the lower Clark Fork River.

The Little Cherry Creek diversion is not predicted to alter fish passage because Little Cherry Creek currently has a series of permanent barriers thought to prevent upstream fish passage under all flow conditions. These barriers limit access to Little Cherry Creek from fish in Libby Creek to the most downstream 950 feet of Little Cherry Creek (Kline Environmental Research 2005b). Downstream fish passage would be unrestricted by the diversion, but the amount of habitat available for the redband trout that inhabit the diverted Little Cherry Creek would decrease. The diversion drainage is proposed to be a permanent structure. Effects on the redband trout population in Little Cherry Creek would be minimal, but would persist long term.

No direct unmitigated losses of fish are predicted from construction or operation of the proposed project. To mitigate the fisheries impacts associated with the Little Cherry Creek diversion and the riprapped tailings impoundment overflow channel to Bear Creek, MMC would implement a Fisheries Mitigation Plan. Before any other mitigation work was attempted, and immediately before closure of the Little Cherry Creek Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. MMC would design the Little Cherry Creek Diversion Channel, to the extent practicable, for fish habitat and passage. MMC's survey of the unnamed tributary to Libby Creek that would receive diverted water indicates that most of the drainage would develop habitat comparable to Little Cherry Creek. MMC would mitigate losses should the Little Cherry Creek Diversion not fully support fish populations formerly associated with Little Cherry Creek. Other fisheries enhancement projects would be implemented to mitigate fisheries losses. While MMC would remove redband trout safely from the section of Little Cherry Creek to be diverted and then place them in the new diversion drainage, some fish mortality due to handling stress may occur during removal, storage,

or replacement. Additionally, the loss of habitat in Little Cherry Creek could cause an indirect loss of trout if the available habitat in the remaining portion of Little Cherry Creek and the diversion drainage did not support the population at its current numbers.

*Lakes*

Low flow in East Fork Rock Creek and East Fork Bull River would provide a barrier to fish moving out of or into Rock Lake and St. Paul Lake during base flow periods. No surface outlet exists at St. Paul Lake; therefore, no effects to fish passage would occur. Westslope cutthroat hybrids exist in Rock Lake. If trout were prevented from moving out of the lake, the westslope cutthroat trout population in East Fork Rock Creek may benefit because some pure westslope cutthroat trout are present in this stream, and the barrier would protect them from hybridization with trout from Rock Lake. Barriers to upstream fish passage into Rock Lake are already present and would not be affected by mine activities.

**Post-mine Operation**

*Streams*

Negligible effects on aquatic populations would occur due to stream crossings once the mine was closed and reclamation completed. Predicted decreased fish habitat and possible flow barriers in the Rock Creek drainage from reduced base flow are expected to continue to a lesser extent during the post-operational period. No additional direct unmitigated losses of fish are expected during the post-operation period.

*Lakes*

The periods of low flow in East Fork Rock Creek are predicted to continue to a lesser extent during post-mine operations. Barriers that prevent fish movement into and out of these lakes may persist. As discussed previously, while these limitations decrease available trout habitat in both streams, they may help reduce hybridization of the westslope cutthroat trout population in East Fork Rock Creek.

### *3.6.4.2.7 Threatened and Endangered Species*

**Construction and Operation of Mine**

*Streams*

Alternative 2 may affect bull trout and their habitat in analysis area streams. As discussed in previous sections, some short-term and, possibly, long-term impacts may result from increases in the amount of fine sediment. Bull trout populations in Libby Creek and the rest of the tributaries would not be directly affected by the loss of habitat in Little Cherry Creek because they do not have access to that habitat as a result of barriers to fish passage near the mouth. Changes in flow within the Libby Creek drainage are expected to be minimal and would not impact the bull trout populations within the drainage. Vegetation clearing and other disturbances are proposed within RHCAs. If riparian shading decreased significantly, increases in stream temperatures would result and would potentially adversely affect bull trout populations. Bull trout require water temperature ranging from 2°C to 15°C, with temperatures at the low end of this range required for successful incubation (USFWS 1998). While sufficient canopy cover data to adequately address this issue are lacking, the removal of additional riparian canopy may increase water temperatures.

Under Alternative 2, bull trout populations in the Libby Creek watershed would continue to be marginal and their habitat in need of restoration work from existing, non-project impacts. Bull

trout populations would continue to be susceptible to decline or disappearance due to hybridization with introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances. Based on limited survey data, brook trout abundances appear to be increasing within the Libby Creek drainage, and habitat degradation generally favors brook trout when competing with bull trout (Rieman and McIntyre 1993). The effect of any habitat change from mine activities in Alternative 2 may indirectly be magnified by giving brook trout an additional competitive advantage. The small resident bull trout population upstream of Libby Creek Falls would be protected from the threat of hybridization or competition with brook trout because the falls prevent access to this segment of Libby Creek from fish downstream.

Bull trout populations in the Rock Creek and East Fork Bull River drainage would be adversely affected by mine activities in Alternative 2. Changes in streamflow may limit bull trout habitat, and may create barriers by reducing base flow within these drainages. Because bull trout spawn from August through November when base flow conditions often occur, available spawning habitat in these streams may decrease. Additionally, bull trout prefer to spawn in areas with ground water discharge because these areas tend to remain open throughout winter, maintain appropriate incubation temperatures, and increase the water exchange rate (Montana Bull Trout Scientific Group 1998). About 0.75 mile below Rock Lake, East Fork Rock Creek enters a flat area with a considerable thickness of alluvium (Rock Creek Meadows). Water storage in the alluvium is likely sufficient to mask any potential decreased base flow at this location and downstream. Predicted changes in base flow above Rock Creek Meadows would likely be measurable, but changes at or downstream of Rock Creek Meadows would not likely be measurable.

Like Rock Creek, if the thickness of the alluvium along East Fork Bull River increased downstream of St. Paul Lake, water storage in the alluvium may be sufficient to mask any potential decreased base flow. Because the East Fork Bull River is considered the most important bull trout stream in the lower Clark Fork River drainage (Montana Bull Trout Scientific Group 1996), decreased levels of bull trout spawning within this stream could have long-term adverse effects on the bull trout population within the lower Clark Fork River drainage.

Components of MMC's Fisheries Mitigation Plan would benefit bull trout populations in the Libby Creek watershed. The mitigation plan includes the genetic analyses of bull trout to determine if any hybridization with brook trout is occurring within the drainage, and one or more habitat restoration projects in Libby Creek and its tributaries. The proposed restoration projects are aimed at creating high quality habitat necessary to sustain wild trout populations.

Components of MMC's fisheries mitigation specifically related to the Libby Creek watershed include: 1) conduct fish investigations to determine the genetics, distribution, and abundance of fishes of concern; 2) rehabilitate habitat upstream from the mouth of Howard Creek through creation of pool and hiding cover habitat, stabilization of old mining spoils, and channel narrowing; enhance habitat values in stream reach immediately downstream of the Libby Adit Site; 3) conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks.

*Lakes*

Bull trout do not inhabit any of the analysis area lakes; the hydrological effects to these lakes would not directly affect bull trout populations.

**Post-mine Operations**

Upon mine closure, mine facility sites and roads would be reclaimed, and effects of mining activities on bull trout populations in the Libby Creek watershed are expected to be minimal. Unrelated to mine activities, hybridization with brook trout would continue to threaten the bull trout populations in the Libby Creek, Rock Creek, and East Fork Bull River watersheds. Additionally, there could be post-mining changes in analysis area streamflows (described in sections 3.10.4.2.1, *Mine Area* and 3.11.4.2.1, *Effects of Inflows During Construction and Mining*). The flow changes may likely be within the range of natural variability for the stream. Predicted flow increases in some streams would provide additional flow during spawning season. Bull trout do not inhabit any of the analysis area lakes; the hydrological effects to these lakes would not directly affect bull trout populations.

Surface runoff from the Little Cherry Creek tailings impoundment would be directed toward Bear Creek, and would likely cause some increases in stream sedimentation during construction of a check dam and diversion channel. Increased stream sedimentation would have a short-term adverse effect on the bull trout population in Bear Creek due to increased sediment in the water column and the substrate. These increases would be temporary, with most of the sediment flushed out of the system during high flow events, such as during snowmelt runoff or rain-on-snow event.

**Effects to Critical Habitat**

The USFWS has designated critical habitat in streams in the analysis area: Rock Creek, East Fork Rock Creek, Libby Creek, Poorman Creek, Ramsey Creek, and West Fisher Creek (Figure 56). Alternative 2 would affect bull trout in both the Clark Fork River and Kootenai River drainages. None of the mine alternatives, including Alternative 2, would affect designated critical habitat in West Fisher Creek. Effects on designated critical habitat in West Fisher Creek are discussed in section 3.6.4.9.3, *Threatened, Endangered, or Sensitive Species* for the transmission line Alternative E.

No roads or other facilities are proposed in any designated segment in Alternative 2. Alternative 2 would affect two segments of designated critical habitat in Libby Creek, one downstream of Howard Creek and one downstream of Little Cherry Creek. The short segments on Ramsey and Poorman creeks also would be adversely affected. Facility construction would occur upstream of the four segments, which would increase sedimentation in these four designated segments. Increased nutrient and metal concentrations also would affect these four segments.

Alternative 2 may affect the four segments of critical habitat in East Fork Rock Creek and Rock Creek and the segments in Libby Creek. Changes in streamflow may limit bull trout habitat, and may create barriers by reducing base flow within these drainages. Because bull trout spawn from August through November when base flow conditions often occur, available spawning habitat in these streams may decrease. During operations and post-operations, diversion from the Little Cherry Creek drainage would reduce average annual flows by 2 to 3 percent in critical habitat between Little Cherry Creek and Bear Creek.

#### *3.6.4.2.8 Sensitive Species*

**Construction and Operation of Mine**

*Streams*

Alternative 2 may impact redband trout. Redband trout inhabit the Libby Creek drainage within the analysis area. Abundance may decrease as a result of possible increases in sediment in Alternative 2. Additionally, the diversion of Little Cherry Creek to accommodate placement of the tailings impoundment would result in a loss of 13,000 feet of redband trout habitat. Because barriers to fish passage exist near the confluence of Little Cherry Creek and Libby Creek, this loss of habitat would not affect the hybrid redband trout populations in Libby Creek and the remaining tributaries within the analysis area. The purity of the redband trout population within Little Cherry Creek has likely persisted due to the location of these barriers, which effectively block the entry of rainbow trout and hybrid trout from Libby Creek into Little Cherry Creek. If the diversion drainage developed similar barriers to upstream passage of fish from Libby Creek, as is expected (Kline Environmental Research 2005a), the pure redband population would persist. If such barriers did not develop, the population would be at risk of hybridization.

MMC's proposed mitigation in Alternative 2 includes the removal of all trout inhabiting Little Cherry Creek and their subsequent transfer to the diversion drainage. These efforts would minimize any immediate loss of trout resulting from the proposed alterations to Little Cherry Creek. Average flow in the diverted Little Cherry Creek would be about 60 percent of the original Little Cherry Creek during operations and 55 percent post-operations. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would probably not support the population at its current numbers.

Alternative 2 may impact westslope cutthroat trout. A pure westslope cutthroat trout population is present in East Fork Bull River and pure and hybrid westslope cutthroat trout exist in the Rock Creek drainage. These trout are present in relatively high densities, particularly in the East Fork Bull River. As with bull trout, reduced base flows in the upstream reaches of these streams during certain times of the year would decrease the amount of available habitat to westslope cutthroat trout populations. While these effects may adversely impact the westslope cutthroat populations in these streams, the higher numbers of westslope cutthroat trout indicate that the populations are at less risk than the bull trout populations. The main risk to westslope cutthroat populations would likely continue to be hybridization and competition with non-native trout.

*Lakes*

Pure populations of redband or westslope cutthroat trout do not inhabit any analysis area lakes; thus, the hydrological effects to these lakes would not directly affect redband or westslope cutthroat trout populations.

**Post-mine Operations**

Post-mining, mine facility sites and roads would be reclaimed, and effects of mining activities on the hybrid redband trout populations in the Libby Creek watershed would be minimal. The diversion drainage is expected to be a permanent structure, and the reduction in stream habitat in the diverted Little Cherry Creek may continue to adversely affect the pure redband trout that would be moved to the channel.

The westslope cutthroat trout populations in Rock Creek would continue to be affected by decreased flows in the stream, although to a lesser extent. The decreased flows are predicted to persist in these streams after mine operations ceased. Hybridization would continue to be the primary threat to the westslope cutthroat trout populations in these watersheds.

Pure populations of redband or westslope cutthroat trout do not inhabit any of the analysis area lakes; thus, the hydrological effects to analysis area lakes would not directly affect these trout populations.

### 3.6.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate the agencies' proposed modifications and mitigating measures that would reduce or eliminate impacts to area streams. Four major mine facilities would be located in alternative locations. The most major change from Alternative 2 would be locating the tailings impoundment at the Poorman Impoundment Site, eliminating the need for a diversion around Little Cherry Creek. Additionally, the plant site would be located between Libby and Ramsey creeks, two additional adits would be constructed in the upper Libby Creek drainage eliminating most construction in the Ramsey Creek watershed, and the disturbance areas for the LAD Areas would be modified to avoid affecting RHCAs.

#### *3.6.4.3.1 Sediment*

**Construction and Operation of Mine**

*Streams*

As with Alternative 2, only the Libby Creek watershed would be at risk from impacts from increased sediment. In general, potential sediment impacts would be reduced in Alternative 3 compared to Alternative 2. Because of the difficulties in quantifying any sediment increases and their effects on aquatic life for either alternative, the extent of the decrease is not known. The locations and structures of the plant site, LAD Area, and impoundment site in Alternative 3 would result in a decreased number of disturbed acres within RHCAs. Alternative 3 would affect 158 acres of RHCAs on National Forest System lands and 9 acres of other riparian areas on private land, substantially less than Alternative 2 (Table 63). RHCAs are shown on Figure 54. Because RHCAs are designed to act as a buffer to protect the streams from sediment as well as other impacts, fewer disturbances within these areas would reduce the amount of sediment that would reach the streams, particularly during the construction phase when sediment impacts have the greatest probability of occurring.

Additional measures would be taken in Alternative 3 to reduce the risk of sediment increases in analysis area streams. The Wildlife Mitigation Plan in Alternative 3 (section 2.5.7.3, *Wildlife Mitigation*) includes 20.3 miles of proposed access changes that would be implemented before MMC would proceed with the Libby Adit evaluation program. Up to 20.1 miles of other proposed access changes would be implemented before any other construction. MMC would build and maintain gates or barriers on the roads, and complete other activities so the roads would either be removed from service, or cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. In most cases, culverts would be removed; such removals would occur in active stream channels requiring instream work, structure placement, and fill removal. In the short term, these activities would increase sedimentation in area streams. After the activities were completed, and the roads became stabilized, habitat in area streams would improve. The Fisheries Mitigation Plan (section 2.5.7.2,

*Fisheries Mitigation*) in Alternative 3 includes implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources in the Libby Creek watershed.

The access changes also would allow the re-establishment of RHCAs along these roads, estimated to be 27 acres in the Libby Creek watershed, 10 acres in the East Fork Rock Creek watershed, and 4 acres in the Fisher River watershed. The Fisheries Mitigation Plan in Alternative 3 includes an inventory of existing sediment sources in Libby Creek and the implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from identified sources.

Because the tailings impoundment in Alternative 3 would not require diversion of a perennial stream and would be located within a smaller watershed, the amount of disturbance and subsequent erosion potential within that area is expected to be less than in Alternative 2. Interim reclamation would occur at the tailings facility, which would result in minimizing sediment in surface water runoff as unreclaimed areas would be limited to active disposal areas. Furthermore, localized sediment retention structures and BMPs for sediment and storm water runoff control would be used. Diversion ditches would be designed to accommodate a 10-year/24-hour storm event and overflows would occur rarely.

Additional measures would be taken in Alternative 3 to incrementally stabilize soil stockpiles and begin revegetation of these stockpiles immediately to reduce erosion. MMC would incrementally stabilize soil stockpiles in Alternative 3 rather than waiting until capacity was reached. Furthermore, replacement of soils in the impoundment area would be based on their erodibility and slope steepness to minimize erosion potential. All permanent cut and fill slopes on roads would be seeded, fertilized, and stabilized.

Based on these measures and the overall decreased amount of disturbed areas within RHCAs, impacts to aquatic life from increased sediment are expected to be substantially reduced compared to Alternative 2. Effects from increased sedimentation in Little Cherry Creek, Poorman Creek, and Ramsey Creek due to mine facilities would be minimal, except potentially in storm events larger than the 10-year/24-hour flood. As discussed previously, even when larger storms occur, the high water volumes would likely flush much of the sediment out of the system. Some sediment increases would likely occur during road construction, but these also would be minimized by adhering to INFS standards and guidelines as well as BMPs. Construction and to a lesser extent operation of the Libby Plant Site Creek would result in small increases in sediment to Libby Creek.

If large storm events occurred and/or erosion control structures failed, increased sediment would enter analysis area streams. With Alternatives 3's mitigation measures, the likelihood of this occurring would less than in Alternative 2. As in Alternative 2, if substantial releases of sediment occurred despite these measures, substantial adverse short-term and/or long-term impacts would be possible to aquatic life.

The probability of catastrophic failure of the tailings impoundment or sediment ponds is low. If a failure were to occur, large masses of sediment (and metals in the case of tailings impoundment failure) could enter analysis area streams and cause substantial alterations in habitat. These alterations would, in turn, cause extensive adverse effects to bull trout populations and other aquatic life. Because the tailings would be thicker than the slurry tailings in Alternative 2, less of

the higher density tailings would be expected to be delivered to nearby streams. If the thicker tailings reached adjacent streams, the higher density of the tailings would make flushing of the system less effective and could slow recovery of the aquatic populations.

The construction of the two additional adits in the Libby Creek drainage would cause minimal increase in sediments in that reach of Libby Creek because the disturbance area associated with the additional adits would be generally small.

*Lakes*

Sediment would not increase in the analysis area lakes during construction or operation of the mine because no surface mining activities would be located near any of the lakes.

**Post-mine Operations**

*Streams*

Once the mine closed, the risk of increased sediment to streams within most of the analysis area would be low. Surface runoff from the Poorman tailings impoundment would be directed toward Little Cherry Creek, and would likely cause some increases in stream sedimentation during initial closure. Increased stream sedimentation would have a short-term adverse effect on fish populations in Little Cherry Creek due to increased sediment in the water column and the substrate. These increases would be temporary, with most of the sediment flushed out of the system during high flow events, such as during snowmelt runoff or rain-on-snow event. Bear Creek would not be affected by Alternative 3.

Alternative 3 includes plans for concurrent and interim reclamation of inactive portions of the tailings impoundment, pipeline corridor, and soil stockpiles. By the time the mine closed, reclamation would have already begun in some disturbed areas. Once vegetation established in these areas, sediment transport in surface runoff would decline. All short- and long-term reclamation objectives in Alternative 2 are retained in Alternative 3, and all of the erosion and sediment control measures described in Alternative 2 also would be implemented. The increased watershed area of Little Cherry Creek would result in an average increase in annual flow, which would increase the sediment load to Little Cherry Creek. Initial sediment loads would have an adverse effect on the aquatic biota, but sediment loads would decrease and the channel would readjust to provide higher quality aquatic habitat than is currently available.

All currently gated or barricaded roads used in Alternative 3 would be decommissioned by using a variety of treatment methods to achieve desired conditions for other resources. Constructed roads would be water-barred and recontoured to prevent increased sedimentation into streams. The existing bridges across Poorman Creek on the Bear Creek Road (NFS road #278) and the Little Cherry Loop Road (NFS road #6212) would be removed at closure and the road revegetated. These measures would result in some short-term increase in sedimentation (*e.g.*, bridge removal), but the long-term effect would be a reduction in sediment input to the streams and no adverse effects to the aquatic biota.

*Lakes*

No sediment increases are projected for St. Paul Lake or Rock Lake during post-mine operation activities in Alternative 3.

#### *3.6.4.3.2 Water Quantity*

**Construction and Operation of Mine**

The primary difference between Alternative 2 and Alternative 3 would be the location of the tailings impoundment between Poorman and Little Cherry creeks. There would be no direct loss of fish habitat in Little Cherry Creek. The watershed contributing to streamflow in Little Cherry Creek would increase by 5 to 8 percent, resulting in a slight increase in available habitat. Any benefits to the fishery would be marginal.

In high elevation stream reaches and lakes, base flow habitat effects resulting from ground water drawdown would be similar for all mine alternatives. Changes in base flows would probably not affect Ramsey Creek because all adits, except the Rock Lake Ventilation Adit, would be in the Libby Creek drainage. Three adits in the Libby Creek drainage may reduce the base flow in Libby Creek more than Alternative 2, but the changes to the aquatic habitat would be small and would have no effect to aquatic life in Libby Creek. No flow-related habitat effects resulting from ground water drawdown are expected to occur in the Little Cherry Creek drainage.

Flow would decrease in Libby Creek by about 4 percent during November through March if make-up water withdrawals occur during those months. Alternative 3 would include the installation of grade control structures in a reach of Libby Creek between Little Cherry Creek and Bear Creek to decrease the width to depth ratio and increase the frequency of deep pool habitat. Grade control structures would improve bedload transport and reduce fine sediment accumulation. Structures would be monitored and maintained for the life of the mine. Population monitoring would be conducted for the life of the mine to determine effectiveness of the structures. Annual monitoring reports describing monitoring results and overall mitigation effectiveness would be submitted to the agencies. The proposed mitigation would minimize the effect of winter-time flow reduction on aquatic habitat.

**Post-mine Operations**

Except for effects on Little Cherry Creek, Alternative 3 post-mining effects would be similar to Alternative 2 (section 3.6.4.2.2, *Water Quantity*). If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow. Flow in Bear Creek would not be affected. Surface water runoff from the tailings impoundment would be routed to an unnamed tributary of Little Cherry Creek. Average annual flow in Little Cherry Creek would increase because the watershed contributing flow to Little Cherry Creek would increase by 44 percent. The larger watershed would increase runoff during stormwater runoff and would not affect base flows. Flow in Libby Creek between Poorman Creek and Little Cherry Creek would decrease very slightly. The reduction in flow in Libby Creek would not be substantial enough to affect the aquatic biota, but the increased flow in Little Cherry Creek would have a long-term benefit to that fishery.

#### *3.6.4.3.3 Water Quality-Nutrients and Metals*

In Alternative 3, all mine drainage water proposed for discharge to the LAD Areas would be pretreated, if necessary. The agencies assumed nitrate removal for the pretreatment system would be 90 percent. Predicted nutrient concentrations are lower than Alternative 2. Water released from the treatment facilities to a nearby stream would be required to meet the BHES Order and MPDES limits. The effect of any increase in TIN and ammonia would be the same as discussed for Alternative 2 (Table 64). The effect on aquatic life in metal concentrations would be the same as Alternative 2 (section 3.6.4.2.4, *Water Quality-Metals*). During mining, Alternative 3 would

not affect the existing water quality in Little Cherry Creek and, therefore, would have no effect on its aquatic life. Post-mining effects were described in sections 3.6.4.2.3, *Water Quality-Nutrients* and 3.6.4.2.4, *Water Quality-Metals*.

Changes in nutrient and metal concentrations in Rock Lake and St. Paul Lake would be the same as discussed for Alternative 2. Reduced productivity may be the most likely effect, reducing production in algae, macroinvertebrates, and fish.

##### *3.6.4.3.4 Fish Passage and Fish Loss*

During construction and operation of the mine, many of the same roads would be used for access to mine facilities in Alternative 3 as in Alternative 2. All bridges proposed for construction or upgrades would comply with INFS standards and guidelines, and would not impact fish passage. Additionally, culverts along a 13-mile segment of Bear Creek Road and along a 1.4-mile of the Libby Creek Road would be replaced as necessary to allow for fish passage. Culvert removal associated with access changes would improve fish passage in affected drainages. There would be no significant adverse effects to fish passage from mine activities in Alternative 3 and the replacement of existing culverts to improve fish passage under this alternative would provide a beneficial effect on fish. MMC would maintain one or more bulkheads underground if hydrologic modeling during initial mine operations (by Year 5 of operations) determined that bulkheads would minimize changes in East Fork Rock Creek and East Fork Bull River streamflows. The effect of reduced base flow on fish passage in East Fork Rock Creek and East Fork Bull River as well as St. Paul Lake and Rock Lake described in Alternative 2 would be less in Alternative 3. Effects of post-mine operation would be the same as Alternative 2.

##### *3.6.4.3.5 Threatened and Endangered Species*

Alternative 3 may affect bull trout and their habitat in analysis area streams during construction and operation of the mine. As with Alternative 2, potential short- and long-term impacts may result from increases in the amount of fine sediment. Many of these effects would be less than in Alternative 2 because the tailings impoundment would not require a stream diversion in Alternative 3, and fewer disturbances in RHCAs would occur.

The Wildlife Mitigation Plan and Fisheries Mitigation Plan in Alternative 3 discussed in section 3.6.4.3.1, *Sediment* would increase sedimentation in bull trout-occupied streams in the short term. After the activities were completed, and the roads became stabilized, habitat in bull trout-occupied streams would improve.

MMC would implement mitigation measures to offset the effects of possible flow changes in the Rock Creek and East Fork Bull River drainages. If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow. MMC would complete a comprehensive aquatic habitat assessment from the confluence of the East Fork Bull River and Snake Creek along the extent of fish habitat in the East Fork Bull River about 1.3 miles past the CMW boundary. Following completion of the habitat inventory, MMC would construct instream structures forming pools and deep water habitat (>1.5 feet depth) from Snake Creek to a location 0.5 mile into the CMW. Work within the CMW would be limited to hand tools and would consist of mainly the addition of LWD. Trail #935 leading to Rock Lake would be converted from a motorized trail to a non-motorized trail, reducing its sediment contribution and increasing riparian habitat along the trail. These measures would improve the bull trout habitat in Rock Creek and the East Fork Bull River.

As with Alternatives 1 and 2, bull trout populations in analysis area streams would continue to be marginal and their habitat in need of restoration work from existing, non-project impacts in Alternative 3. Bull trout populations would continue to be susceptible to decline or disappearance due to hybridization with introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances.

**Effects to Critical Habitat**

No roads or other facilities are proposed in any designated critical habitat segment in Alternative 3. Alternative 3 would affect the same segments in East Fork Rock Creek and Rock Creek as Alternative 2. If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to East Fork Rock Creek streamflow. Alternative 3 would avoid construction of an impoundment in Little Cherry Creek and diversion of the creek. Effects on the designated critical habitat on Libby Creek below Little Cherry Creek would be same as Alternative 2 during operations, decreasing average annual flow by about 2 percent. Post-operations, Alternative 3 would not affect the designated critical habitat on Libby Creek below Little Cherry Creek.

Sedimentation in the designated segments would be minimized through access changes in the Rock Creek, Libby Creek, and Miller Creek watersheds, implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources in the Libby Creek watershed, and the installation of structures in bull trout critical habitat between Little Cherry Creek and Bear Creek. TIN, copper, and zinc concentrations are likely to be similar to Alternative 2 (sections 3.6.4.2.3, *Water Quality-Nutrients* and 3.6.4.2.4, *Water Quality-Metals*). These measures would decrease the risk of changes in water quantity, or increased sedimentation in designated critical habitat in Libby, Ramsey, and Poorman creeks.

### *3.6.4.3.6 Sensitive Species*

**Construction and Operation of Mine**

Alternative 3 may adversely affect pure redband trout populations. Potential effects to the redband trout populations in the Libby Creek drainage would be less in Alternative 3 than in Alternative 2 (section 3.6.4.2.8, *Sensitive Species*). In Alternative 3, no diversion of Little Cherry Creek would be necessary, and the population in Little Cherry Creek would not be adversely affected. A small flow increase in Little Cherry Creek would result in a long-term benefit to the redband trout population in the creek. Redband trout in the remainder of the Libby Creek drainage are largely hybridized and effects are expected to be minimal and to be less than those predicted in Alternative 2 in many cases. Alternative 3 may impact westslope cutthroat trout populations in the Rock Creek and East Fork Bull River drainages and would be similar to Alternative 2 (section 3.6.4.2.8, *Sensitive Species*). The primary risk to both the redband and the westslope cutthroat populations would remain hybridization, which is unrelated to mine activities.

**Post-mine Operations**

Upon mine closure, reclamation of mine facility sites and roads would occur, and effects of mining activities on redband trout populations in the Libby Creek watershed are expected to be minimal. Surface runoff from the Poorman tailings impoundment would be directed toward Little Cherry Creek, and would likely cause some increases in stream sedimentation during construction of a check dam and diversion channel. Increased stream sedimentation would have a short-term adverse effect on redband trout population in Little Cherry Creek due to increased sediment in the water column and the substrate. These increases would be temporary, with most of the sediment flushed out of the system during high flow events, such as during snowmelt runoff or rain-on-

snow. Post-operation flows would substantially increase in Little Cherry Creek as the result of increases in watershed size, which may positively affect the pure redband trout in this stream in the long term. Short-term increases in sedimentation and scour may have an adverse effect on the redband population initially. Effects to westslope cutthroat trout in Rock Creek and the East Fork Bull River would be similar to Alternative 2 (section 3.6.4.2.8, *Sensitive Species*). If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow. Hybridization would remain the primary threat to both redband and westslope cutthroat populations.

### 3.6.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 2, with modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4.

#### *3.6.4.4.1 Sediment*

**Construction and Operation of Mine**

In general, potential sediment impacts would be reduced in Alternative 4 compared to Alternative 2 (section 3.6.4.2.1, *Sediment*), but would be similar or greater than those predicted for Alternative 3. Due to difficulties in quantifying any sediment increases and their effects on aquatic life for any of the alternatives, the extent of these differences is not known. Under Alternative 4, the permit and disturbance boundaries for the Little Cherry Creek Tailings Impoundment Site would be modified to reduce effects on RHCAs in this drainage. Alternative 4 would affect 206 acres of RHCAs on National Forest System lands and 143 acres of other riparian areas on private lands (Table 63). Because RHCAs are designed to act as buffers to protect the streams from sediment as well as other impacts, fewer disturbances within these areas would reduce the amount of sediment that would reach the streams, particularly during the construction phase when the sedimentation impacts are expected to be the most severe.

The diversion channel in Alternative 4 would be constructed to minimize erosion. Some periodic increases in sediment in the lower channels and Libby Creek would occur, particularly during storm events. As discussed in section 3.6.4.2.1, *Sediment*, these increases would be expected to only persist in the short term because much of the sediment would likely be flushed out of the upper Libby Creek drainage by the high flows. The probability of catastrophic failure of the tailings impoundment is low, but if it were to occur, short- and long-term effects would occur to the aquatic habitat and aquatic life as described in Alternative 2 (section 3.6.4.2.1, *Sediment*).

The mitigation plans for Alternative 4 regarding sediment reduction would be the same as Alternative 3 (section 3.6.4.3.1, *Sediment*). Proposed road and trail access changes and implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources would minimize the net contribution of sediment to the Libby Creek watershed.

**Post-mine Operations**

Minimal increases in sedimentation would be expected in Alternative 4 once mine operations ceased. Additional sedimentation of the diversion channels may occur as the channels re-established to accommodate runoff from the tailings impoundment. Any sedimentation would

adversely affect the transplanted redband trout population in diverted Little Cherry Creek. The increase in sediment in Bear Creek in Alternative 2 from surface runoff from the tailings impoundment would not occur in Alternative 4. All short- and long-term reclamation objectives in Alternative 2 are retained in Alternative 4, and all of the erosion and sediment control measures described in Alternative 2 and 3 also would be implemented.

#### *3.6.4.4.2 Water Quantity*

Alternative 4 is essentially the same as Alternative 3, with the exception being the location of the tailings impoundment in the Little Cherry Creek drainage rather than north of Poorman Creek. Flow-related habitat changes in East Fork Rock Creek and East Fork Bull River as a result of construction and mining, including proposed mitigation, would be the same as those described in Alternative 3. Effects on Libby Creek and its tributaries except Little Cherry Creek would be similar to those of Alternative 2 (section 3.6.4.3.2, *Water Quantity*). As in Alternative 2, average flow in the diverted Little Cherry Creek would be about 60 percent of the original Little Cherry Creek. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not likely support the population at its current numbers.

Alternative 4 post-mining effects would be similar to Alternative 3 (section 3.6.4.3.2, *Water Quantity*) except for effects to diverted Little Cherry Creek and former Little Cherry Creek. Surface runoff from the impoundment would be directed to the diverted Little Cherry Creek and flows would be greater than flows during operations. Average flow in the diverted creek would be about 90 percent of the original Little Cherry Creek flows. The higher flows would provide better habitat than during operations, but slightly less than currently in Little Cherry Creek.

#### *3.6.4.4.3 Water Quality-Nutrients and Metals*

As with Alternatives 2 and 3, increased nutrient and metal concentrations may occur in analysis area streams in the Libby Creek watershed (sections 3.6.4.2.3, *Water Quality-Nutrients* and 3.6.4.2.4, *Water Quality-Metals*). The effects on aquatic life would be the same as Alternative 3.

#### *3.6.4.4.4 Toxic Metals in Fish*

Changes in metal concentrations in fish would be the same as discussed for Alternative 2 (section 3.6.4.2.5, *Toxic Metals in Fish*).

#### *3.6.4.4.5 Fish Passage and Fish Loss*

**Construction and Operation of Mine**

*Streams*

Many of the same roads would be used for access to mine facilities in Alternative 4 as in Alternative 2. As in Alternative 3, all proposed construction or upgrades to bridges would comply with INFS standards and guidelines and KNF BMPs, and culverts along 13-mile segment of the Bear Creek Road and a 1.4-mile segment of the Libby Creek Road and Upper Libby Creek Road would be replaced as necessary to allow for fish passage. Culvert removal associated with road closures also would improve fish passage. As with Alternative 3, there would be beneficial effects to fish passage from mine activities in Alternative 4.

The Diversion Channel would be designed for fish passage, which would provide better fish habitat than Alternative 2. The same procedures for removal of fish from the portion of Little Cherry Creek under the tailings impoundment would be followed, as in Alternative 2, and the fish

would be placed back into diverted Little Cherry Creek following the watering of the diversion ditch. Some fish mortality is possible from handling stress through removal and replacement methods, but would be minimal. Changes in fish passage in East Fork Bull River and Rock Creek drainages would be the same as Alternative 3 (section 3.6.4.3.4, *Fish Passage and Fish Loss*).

**Post-mine Operation**

There would be minor effects on aquatic populations due to stream crossings once the mine closed and reclamation was completed. Changes in the streams and lakes of the East Fork Bull River and Rock Creek drainages would be the same as Alternative 3 (section 3.6.4.3.4, *Fish Passage and Fish Loss*).

#### *3.6.4.4.6 Threatened and Endangered Species*

**Construction and Operation of Mine**

*Streams*

Alternative 4 may affect bull trout. Adverse effects to bull trout populations are possible in Alternative 4 from increases in the amount of fine sediment, increases in stream concentrations of nutrients and copper and zinc, and possible bioaccumulation of metals that may occur in the Libby Creek watershed as a result of mine activities. These effects are expected to be less in Alternative 4 than Alternative 2. The diversion of Little Cherry Creek is expected to have minimal direct effects on the bull trout populations within the Libby Creek drainage because bull trout do not access that portion of Little Cherry Creek. The risk of sedimentation or increased temperatures from decreased riparian shading would be greater than Alternative 3 and similar to Alternative 2. Due to its isolation, the bull trout population in Libby Creek is particularly susceptible to degradation of stream habitat or water quality.

The Wildlife Mitigation Plan and Fisheries Mitigation Plan in Alternative 4 would be the same as Alternative 3 (section 3.6.4.3.1, *Sediment*) and would benefit bull trout populations in the Libby Creek watershed. Objectives of this mitigation plan include reducing sediment sources and bank erosion, stabilizing the stream channel, and improving habitat for bull trout and redband trout. As in all alternatives, bull trout populations in the Libby Creek watershed would continue to be marginal as a result of non-project impacts such as hybridization and competition with non-native trout present within the drainage.

Effects to bull trout populations in the Rock Creek and East Fork River drainages are predicted to be the same in Alternative 4 as in Alternative 3 (section 3.6.4.3.5, *Threatened and Endangered Species*). There is the potential for adverse long-term and short-term effects to bull trout populations from the decreased flows in these drainages.

*Lakes*

Bull trout do not inhabit any of the analysis area lakes; the hydrological effects to these lakes would not directly affect bull trout populations.

**Post-mine Operation**

*Streams*

Once mine operations ceased, mine facility sites and roads would be reclaimed, and bull trout habitat in the Libby Creek watershed would return to pre-mine or better than pre-mine conditions, given the habitat improvement work. Hybridization and competition with brook trout would

continue to be a threat to bull trout populations in the Libby Creek watershed. As in Alternative 3, if necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow. Adverse impacts to bull trout populations due to flow changes in Rock Creek and the East Fork Bull River are predicted to continue during post-mine operations.

*Lakes*

Bull trout do not inhabit any of the analysis area lakes; the hydrological effects to these lakes would not directly affect bull trout populations.

**Effects to Critical Habitat**

No roads or other facilities are proposed in any designated critical habitat segment in Alternative 4. Alternative 4 would affect the same four segments in East Fork Rock Creek and Rock Creek and the segments in Libby Creek as Alternative 2 (section 3.6.4.2.7, *Threatened and Endangered Species*). Effects on the designated critical habitat on Libby Creek below Little Cherry Creek would be same as Alternative 2 during operations, decreasing average annual flow by about 2 percent. Post-operations, Alternative 3 would not affect the designated critical habitat on Libby Creek below Little Cherry Creek. The mitigation measures in Alternative 3 would be implemented, and would decrease the risk of changes in water quality, water quantity, or increased sedimentation in designated critical habitat in Libby, Ramsey, and Poorman creeks.

#### *3.6.4.4.7 Sensitive Species*

**All Phases**

*Streams and Lakes*

Alternative 4 may impact redband trout. Effects to the hybrid redband trout populations within the Libby Creek drainage in Alternative 4 would be similar to effects described in Alternative 2 (section 3.6.4.2.8, *Sensitive Species*). The diversion drainage would have higher flow post-mining and be designed for fish passage, which would provide better fish habitat than Alternative 2. The effects of the proposed mitigation plan would be the same as Alternative 3. Effects on westslope cutthroat trout would be the same in Alternative 4 as in Alternative 2 (section 3.6.4.2.8, *Sensitive Species*).

### 3.6.4.5 Alternative A – No Transmission Line Alternative

In Alternative A, the transmission line and substation for the Montanore Project would not be built. Possible impacts to aquatic resources due to construction, operation, and maintenance of a new transmission line would not occur. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

### 3.6.4.6 Alternative B – North Miller Creek Transmission Line Alternative

MMC's proposed alignment for the transmission line would be in the Fisher River, Miller Creek, and Libby Creek watersheds. The proposed alignment would follow the Fisher River and U.S. 2 north from the substation for 4 miles, with the alignment turning west to generally follow the

Miller Creek drainage for 2.5 miles. It would then traverse a tributary to Miller Creek, cross into the upper Midas Creek drainage, and then down to Libby Creek and Ramsey Creek. This alternative would potentially cause the greatest amount of disturbance close to a stream. None of the transmission line alternatives have any effect on analysis area lakes; only the effects of the alternatives on stream habitat and aquatic populations in area streams are discussed. The transmission line would be removed following mine closure and reclamation, resulting in additional disturbance. All remaining roads and disturbed areas would be contoured and revegetated following closure of the mine; any long-term effect from these activities on the aquatic habitat and populations would be minor.

#### *3.6.4.6.1 Sediment*

A construction Storm Water Pollution Prevention Plan would be developed and implemented to minimize the discharge of pollutants resulting from Alternative B. Structural and non-structural BMPs would be implemented to minimize stream sedimentation. The primary sources of sediment during construction of the transmission line would include timber clearing, road construction, and road upgrades. The transmission line would span six streams: Hunter Creek, Fisher River, unnamed tributary of Miller Creek, Howard Creek, Libby Creek, and Ramsey Creek. In Alternative B, two structures would be located immediately adjacent to the Fisher River and sediment would likely reach the river despite BMPs to reduce sediment transport. Similarly, the access road between these two structures would introduce sediment to the Fisher River because the road would be located adjacent to the river. Two other structures would be located immediately adjacent to Miller Creek (Figure 42). Construction would introduce sediment to Miller Creek. Stream crossings would be constructed to meet KNF and DEQ requirements. Disturbance on active floodplains would be minimized to reduce sedimentation to streams during annual runoff, and construction activities would be curtailed during heavy rains to reduce erosion.

**Road Construction and Reconstruction**

Section 3.18, *Soils and Reclamation* discusses the effects on highly erodible soils and soils with high sediment delivery. Alternative B would disturb 8.9 acres for new access roads or roads with high upgrade requirements on soils having severe erosion risk, the majority of which occur along Libby and Miller creeks and Fisher River (Table 134). Most soils with high sediment delivery potential disturbed by access roads occur along Ramsey, Libby, and Miller creeks and Fisher River (Figure 82). Some sediment increases would occur, particularly during periods of high activity or large storm events. Following Environmental Specifications (Appendix D) and using BMPs would minimize impacts during construction.

All transmission line alternatives would require the construction of new roads. Road construction would be the primary contributor to sediment in area streams. Alternative B would require 9.9 miles of new road construction (Table 66). One major stream (the unnamed tributary of Miller Creek that Alternative B follows) and four minor unnamed tributary streams would be crossed by new roads in Alternative B (Table 66). An analysis was made of the combined effects of the mine alternatives with the transmission line alternatives from new road construction. The combination of mine alternative 2 and transmission line alternative B would require the most new road construction (17.2 miles). New road construction in the other mine and transmission line alternative combinations would be less, ranging from 9.3 miles to 10.1 miles (Table 66).

**Table 66. Stream Crossings and New Road Requirements by Alternatives and Alternative Combinations.**

| Alternatives | Number of Stream Crossings by Transmission Line | | Number of Stream Crossings by New Roads | | Miles of New Road Construction |
|---|---|---|---|---|---|
| | Major Stream | Minor Stream | Major Stream | Minor Stream | |
| ***Transmission Line Alternatives*** | | | | | |
| B | 6 | 16 | 1 | 4 | 9.9 |
| C | 6 | 13 | 0 | 3 | 3.0 |
| D | 8 | 13 | 0 | 5 | 3.3 |
| E | 9 | 13 | 0 | 4 | 3.5 |
| ***Combined Mine and Transmission Line Alternatives*** | | | | | |
| 2 B | 6 | 16 | 4 | 5 | 17.2 |
| 3 C | 6 | 13 | 1 | 4 | 9.3 |
| 3 D | 8 | 13 | 1 | 6 | 9.6 |
| 3 E | 9 | 13 | 1 | 5 | 9.8 |
| 4 C | 6 | 13 | 2 | 4 | 9.6 |
| 4 D | 8 | 13 | 2 | 6 | 9.9 |
| 4 E | 9 | 13 | 2 | 5 | 10.1 |

Source: GIS analysis by ERO Resources Corp. using KNF data.

### Riparian Areas

Clearing vegetation, constructing new roads, and upgrading roads in Alternative B would disturb 31 acres of RHCAs on National Forest System lands and 33 acres of other riparian areas on private land (Table 67). Sediment delivery would likely increase substantially, stream habitat would be altered in the short term and, consequently, fish and other aquatic populations would be adversely affected as well. The pure redband trout population in the Fisher River and the pure westslope cutthroat trout in Miller Creek may be adversely affected by sediment increases under this alternative, at least in the short term. Trout and sculpin populations in the other streams could also be affected.

An analysis was made of the combined effects of the mine alternatives with the transmission line alternatives on RHCAs on National Forest System lands and other riparian areas on private and state lands. Effects on RHCAs on National Forest System lands would range from 176 acres with mine Alternative 3 and transmission line Alternative C to 277 acres for mine Alternative 2 and transmission line Alternative B (Table 68). Much of the "other private" land affected by combinations with mine Alternatives 2 and 4 is owned by MMC in the Little Cherry Creek Impoundment Site.

**Table 67. Effects on RHCAs and Riparian Areas by Transmission Line Alternatives.**

| | Alternative B – North Miller Creek | Alternative C – Modified North Miller Creek | Alternative D – Miller Creek | Alternative E – West Fisher Creek |
|---|---|---|---|---|
| ***Riparian Areas within Clearing Area*** † | | | | |
| RHCAs on National Forest System lands (ac.) | 31 | 18 | 56 | 36 |
| Other riparian areas on private or state lands (ac.) | 33 | 22 | 26 | 27 |
| Total (ac.) | 64 | 40 | 82 | 63 |
| ***Number of Structures within Riparian Areas*** ‡ | | | | |
| RHCAs on National Forest System lands | 7 | 2 | 5 | 5 |
| Other riparian areas on private or state lands | 12 | 4 | 4 | 8 |
| Total | 19 | 6 | 9 | 13 |

†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot-width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
New and upgraded roads are included in the acreage.
INFS standards apply only to National Forest System lands.
‡Number and location of structures are based on preliminary design.
Source: GIS analysis by ERO Resources Corp. using KNF data.

**Table 68. Effects on Riparian Areas by Combination of Mine and Transmission Line Alternatives.**

| Combination of Alternatives | RHCAs on National Forest System Lands | Other Riparian Areas | | | Total |
|---|---|---|---|---|---|
| | | State | Plum Creek Timber Company | Other Private | |
| 2 and B | 277 | 0 | 33 | 148 | 458 |
| 3 and C | 176 | 0 | 22 | 9 | 208 |
| 3 and D | 214 | 0 | 22 | 14 | 249 |
| 3 and E | 194 | 12 | 15 | 9 | 231 |
| 4 and C | 247 | 0 | 51 | 143 | 441 |
| 4 and D | 261 | 0 | 22 | 147 | 431 |
| 4 and E | 242 | 12 | 15 | 143 | 412 |

All units are in acres. Acreage is based the disturbance area for mine alternatives and, for transmission line alternatives, on a 150-foot clearing width for monopoles (Alternative B) and 200-foot-width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Roads opened or constructed for transmission line access would be closed after the transmission line had been built. The road surface would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. Sediment delivery would decrease following reseeding. Transmission line maintenance may periodically result in short-term sediment increases to streams at locations where the transmission line was located adjacent to or crossed streams. Transmission line decommissioning also would result in a short-term sediment increase to the streams.

##### *3.6.4.6.2 Water Quantity*

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would increase by 8.6 percent for Ramsey Creek, with a combination of Alternative 2 and the transmission line Alternative B. All other stream peak flows in the analysis area would not be affected by Alternative B. This small percent increase would not result in any changes to fish habitat in Ramsey Creek.

##### *3.6.4.6.3 Threatened, Endangered, or Sensitive Species*

Alternative B may affect bull trout and their habitat. Vegetation clearing and road construction during construction would result in short-term increases of sediment in the Fisher River and Libby Creek drainages occupied by bull trout. Substantial increases in fine sediment are unlikely to occur past the construction period, except during line decommissioning when short-term increases are expected. Following Environmental Specifications and using BMPs would minimize impacts.

Alternative B may affect designated bull trout critical habitat. Alternative B would cross Howard Creek and Libby Creek about 0.3 mile upstream of designated critical habitat in Libby Creek below the confluence with Howard Creek. Vegetation clearing and road construction during construction would result in short-term increases of sediment in this designated section. Similar effects would occur during line decommissioning.

Alternative B may affect redband trout and westslope cutthroat trout. The pure and hybrid redband trout populations that exist in the Fisher River, Miller Creek, and Libby Creek drainages may be adversely affected by releases of fine sediment that occur from the land clearing and road construction necessary for transmission line installation. A pure westslope cutthroat trout population is found in Miller Creek. The population may be affected in a manner similar to the hybrid redband trout population. Following Environmental Specifications and using BMPs would minimize impacts.

#### 3.6.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

The primary modification in Alternative C to MMC's proposed North Miller Creek Alternative would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification results in the transmission line crossing less area with soils that are highly erosive and subject to high sediment delivery and slope failure. H-frame poles, which generally allow for longer spans and fewer structures and access roads, would be used for this alternative. In some locations, a helicopter would be used to place the structures. As in Alternative B, transmission line construction and operation are not expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure,

resulting in additional disturbance. All remaining roads and disturbed areas would be contoured and revegetated following closure of the mine; any long-term effect from these activities on the aquatic habitat and populations would be minor.

#### *3.6.4.7.1 Sediment*

Compared to Alternative B, Alternative C has numerous changes that would reduce effects on aquatic life in streams along the transmission line corridor:

- Fewer structures and access roads in the Fisher River floodplain
- Fewer structures and access roads on highly erodible soils
- Fewer structures and access roads in RHCAs
- Structures farther from Miller Creek
- Placement into intermittent stored service of all new roads on National Forest System lands
- Use of helicopter for structure placement and vegetation clearing in some areas
- Implementation of a Vegetation Removal and Disposition Plan to reduce clearing
- Limited use of heavy equipment in RHCAs

**Road Construction and Reconstruction**

The modifications incorporated into Alternative C would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads, and decreasing erosion by altering the alignment of the transmission line. Stream crossings of the transmission line would be the same as Alternative B (Table 66), except Sedlak Creek would be crossed and Ramsey Creek would not be. No major streams and three smaller tributaries would be crossed by new roads in Alternative C (Table 66). New access roads and closed roads with high upgrade requirements in Alternative C would disturb 4.2 acres of soils having severe erosion risk, and 1.5 acres of soils with high sediment delivery potential (Table 134). Most soils having severe erosion risks along access roads occur along Libby Creek in the extreme western portion of the transmission line, and along Miller Creek and near the Fisher River crossing (Figure 82). Soils having high sediment delivery potential along access roads occur along Libby and Miller creeks and at the northeast end along the Fisher River. Most soils having potential for slope failure along access roads occur just east of Libby Creek, along Miller Creek and east of Fisher River. Some sediment increases would occur, particularly during periods of high activity or large storm events. Following Environmental Specifications (Appendix D) and using BMPs would minimize any impacts during the construction period.

Alternatives C, D, and E would include the placement of NFS road #4725 into long-term intermittent stored status. Mitigation would reduce sediment contribution from this road.

**Riparian Areas**

Alternative C would 18 acres of RHCAs on National Forest System lands and 22 acres of other riparian areas on private lands (Table 67). Based on a preliminary design, four structures would be in a RHCA on National Forest System lands and two structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, and using a helicopter for line stringing, logging, and decommissioning new

access roads on National Forest System lands after construction would reduce contributions of sediment to area streams. Some periodic sediment increases would likely still occur within the streams, but the frequency and magnitude of these increases would be substantially less than in Alternative B. MMC would use the same general methods to operate, maintain, and reclaim the line and access roads as in Alternative B. Effects of sediment on fish populations of the four streams would be less than the effects of Alternative B (section 3.6.4.6.1, *Riparian Areas*).

#### *3.6.4.7.2 Water Quantity*

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative C. No peak flow-related habitat effects would occur within the analysis area.

#### *3.6.4.7.3 Threatened, Endangered, or Sensitive Species*

Alternative C may affect bull trout, hybrid redband trout, and hybrid westslope cutthroat trout populations and their habitat in area drainages. The measures discussed in section 3.6.4.7.1, *Sediment* would minimize impacts on bull trout, redband trout, and westslope cutthroat trout populations. Alternative C may affect designated bull trout critical habitat. Effects of Alternative C on critical habitat downstream of the Howard Creek and Libby Creek confluence would be the same as Alternative B (section 3.6.4.6.3, *Threatened, Endangered, or Sensitive Species*). Fisheries mitigation described for mine Alternative 3 (section 3.6.4.3.1, *Sediment*) would offset these effects.

### 3.6.4.8 Alternative D – Miller Creek Transmission Line Alternative

This alternative modifies MMC's proposal using the measures described for Alternative C (3.6.4.7.1, *Sediment*). Instead of being routed along an unnamed tributary of Miller Creek, the alignment would follow along Miller Creek into the Howard Creek drainage. As in Alternative B, transmission line construction and operation are not expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure and reclamation, resulting in additional disturbance. All remaining roads and disturbed areas would be contoured and revegetated following closure of the mine; any long-term effect from these activities on the aquatic habitat and populations would be minor.

#### *3.6.4.8.1 Sediment*

The modifications incorporated into Alternative D would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads and decreasing erosion by altering the transmission line alignment. The transmission line would cross eight streams: Sedlak Creek, Hunter Creek, Fisher River, unnamed tributary to Miller Creek, Miller Creek, Howard Creek twice, and Libby Creek (Table 66).

**Road Construction and Reconstruction**

Alternative D would require 3.3 miles of new roads (Table 66). This alignment also would cross less area with soils that are highly erosive and subject to high sediment delivery and slope failure than Alternative B (Table 134). New access roads and closed roads with high upgrade requirements would disturb 4.2 acres of soils having severe erosion risks, and 1.5 acres of soils with high sediment delivery potential (Table 134). Most soils having severe erosion risks along access roads occur along Libby Creek in the extreme western portion of the transmission line, along Miller Creek and Fisher River. The majority of soils with high sediment delivery potential along access roads occur along Libby and Miller creeks and at the northeast end along the Fisher

River (Figure 82). No major streams and five smaller tributaries would be crossed by new roads in Alternative D (Table 66). Some sediment increases would occur, particularly during periods of high activity or large storm events. Following Environmental Specifications (Appendix D) and using BMPs would minimize any impacts during the construction period.

**Riparian Areas**

Disturbance within riparian areas would be greater than Alternative B, with 56 acres of RHCAs on National Forest System lands and 26 acres of other riparian areas on private lands (Table 67). Based on a preliminary design, five structures would be in a RHCA on National Forest System lands and four structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, and using a helicopter for line stringing and site clearing would minimize contributions of sediment to area streams.

#### *3.6.4.8.2 Water Quantity*

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative D. No peak flow-related habitat effects would occur within the analysis area.

#### *3.6.4.8.3 Threatened, Endangered, or Sensitive Species*

Effects on bull trout and redband trout would be the same as Alternative C (section 3.6.4.7.3, *Threatened, Endangered, or Sensitive Species*). More structures would be near Miller Creek than Alternatives B and C, potentially affecting the pure westslope cutthroat trout population in Miller Creek.

Alternative D may affect designated bull trout critical habitat. Alternative D would cross Howard Creek about 0.4 mile upstream and Libby Creek about 0.3 mile upstream of designated critical habitat in Libby Creek below the confluence with Howard Creek. Vegetation clearing and road construction during construction would result in short-term increases of sediment in this designated section. Similar effects would occur during line decommissioning. Fisheries mitigation described for Alternative 3 (section 3.6.4.3.1, *Sediment*) would offset these effects.

### 3.6.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

This alternative modifies MMC's proposed North Miller Creek alignment by routing the line east to generally follow West Fisher Creek. H-frame poles, which generally allow for longer spans and fewer structures and access roads, would be used for this alternative. Alternative E includes measures described for Alternative C (section 3.6.4.7.1, *Sediment*) except for the modifications along Miller Creek. As in Alternative B, transmission line construction and operation are not expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure and reclamation, resulting in additional disturbance. All remaining roads and disturbed areas would be contoured and revegetated following closure of the mine. Any effects from these activities on the aquatic habitat and populations would be minor post-operation.

#### *3.6.4.9.1 Sediment*

The modifications incorporated into Alternative E would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads and decreasing erosion by altering the transmission line alignment. The transmission line would cross nine

streams: Sedlak Creek, Hunter Creek, Fisher River, West Fisher Creek, two unnamed tributaries of West Fisher Creek, Howard Creek twice, and Libby Creek (Table 66). This alignment also would cross less area with soils that are highly erosive and subject to high sediment delivery and slope failure than the other alternatives (Table 134).

**Road Construction and Reconstruction**

Alternative E would require 3.5 miles of new roads (Table 66). New access roads and closed roads with high upgrade requirements would disturb 3.1 acres of soils having severe erosion risks (Table 134), which occur primarily along occur along Libby and West Fisher creeks and Fisher River (Figure 82). This alternative would affect very few soils with high sediment delivery potential (0.5 acre). No major streams and four smaller tributaries would be crossed by new roads in Alternative E (Table 66). Some sediment increases would occur, particularly during periods of high activity or large storm events. Following Environmental Specifications (Appendix D) and using BMPs would minimize any impacts during the construction period.

**Riparian Areas**

Disturbance within riparian areas would be more than Alternative B, with 36 acres of RHCAs on National Forest System lands and 27 acres of other riparian areas on private or state lands (Table 67). Based on a preliminary design, five structures would be in a RHCA on National Forest System lands and eight structures would be in a riparian area on private or state lands. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, and using a helicopter for line stringing and site clearing would minimize contributions of sediment to area streams.

#### *3.6.4.9.2 Water Quantity*

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative E. No peak flow-related habitat effects would occur within the analysis area.

#### *3.6.4.9.3 Threatened, Endangered, or Sensitive Species*

Alternative E may affect bull trout and redband trout and their habitat. Effects on redband trout would be similar to Alternatives C and D. Alternative E would have more effect on bull trout than the other alternatives. About 6 miles of line and 1.5 miles of new or upgraded access roads would be in the Fisher River and West Fisher Creek watersheds, which provide occupied bull trout habitat. Measures described for Alternative C (section 3.6.4.7.1, *Sediment*), except for the modifications along Miller Creek, would minimize effects.

Alternative E would follow West Fisher Creek for about 5 miles; two segments of designated bull trout critical habitat are located in the creek (Figure 56). The existing Libby Creek Road (NFS road #231) would be between the creek, and the transmission line and any newly constructed roads. There would be increased sedimentation during construction and decommissioning activities. Bull trout critical habitat would be adversely affected during these times. Effects of Alternative E on the critical habitat downstream of the Libby Creek and Howard Creek confluence would be the same as Alternative D (section 3.6.4.8.3, *Threatened, Endangered, or Sensitive Species*). Fisheries mitigation described for Alternative 3 (section 3.6.4.3.1, *Sediment*) would offset these effects.

### 3.6.4.10 Cumulative Effects

Cumulative effects in the analysis area include past and current actions that are likely to continue in the future and reasonably foreseeable actions that could affect aquatic biota. This includes other area mining activities, particularly instream suction dredging and placer exploration, which in the past have created physical substrate habitat alterations in area streams. Suction dredging tends to destabilize stream channels and may alter streamflows, particularly during high flows. There are also ongoing and planned mine reclamation activities. Other activities that could affect the aquatic biota include timber harvesting, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stream channel and bank stabilization or restoration projects. These activities can either have adverse or beneficial effects to the aquatic biota.

The ground water numerical model was used to predict base flow changes to streams due to implementing both the Montanore and Rock Creek Projects. Effects to streamflow would remain the same for Libby and Ramsey creeks. In Rock Creek, about 1.25 miles downstream of Rock Lake, decreased base flow would be greater with operation of the Rock Creek Project. In the East Fork Bull River, decreased base flow would be greater throughout the length of the stream during mining and also would decrease post-mining. When placed into the context of a likely loss of habitat under MMC alternatives, the cumulative effects would result in additional habitat loss downstream of Rock Lake and St. Paul Lake including the bull trout spawning period. Habitat improvements in the East Fork Bull River would offset the habitat loss associated with the Montanore Project.

No impacts related to the Rock Creek Project are anticipated in the Bull River drainage, which is considered to be the principal contributor of the core area, because it supports relatively strong numbers of adfluvial, fluvial, and resident bull trout. Impacts of the Rock Creek Project are anticipated to only affect the local population of bull trout in Rock Creek, and these impacts are expected to result from sediment delivery during the construction period and 2 years following. The effect of sediment intrusion into the stream channel should be minimized by the proposed sediment abatement measures and vegetation buffer zones. Risks to bull trout could increase if the Rock Creek Project causes water quality and water quantity changes that affect streamflows in Rock Creek. It is difficult to determine with any certainty whether a risk to bull trout would exist under project implementation because of the lack of data or pertinent scientific information on the relationship of underground mining effects on aquatic species (USFWS 2007a).

In Rock Creek, the functioning of the core area population would be maintained and the risk from natural environmental changes would be unaffected. This is largely because of the strength and stability of the remaining local populations, the relatively small contribution of Rock Creek bull trout to the core area population, and the recovery efforts now underway with fish passage and habitat restoration activities addressing the main threats to the core area population. There may be a slight slowing in the rate of recovery for the core area population because of the slight loss in recruitment potential, but if current efforts to recover the adfluvial component under the Avista program continue to be successful and overshadow the potential loss, the recovery rate of the core area may not be affected (USFWS 2007a).

The Avista fish passage program is well-funded with full-time dedicated staff to implement the trap and transport of bull trout for the entire 45-year licensing period. The Avista program has identified and implemented habitat acquisition and restoration projects as funding allows.

Cooperative efforts between Avista, FWP, and local watershed groups are providing long-term habitat protection through land acquisition, conservation easements, and watershed restoration. Fragmentation of the historical migratory populations in the lower Clark Fork River was considered the highest risk, but this threat has been addressed with consolidation of four core areas into one (Lower Clark Fork Core Area) as a result of the success of the Avista fish passage program (USFWS 2007a)

Any loss of bull trout from these cumulative impacts would represent an irretrievable loss of genetic diversity. Improvements in habitat quality and productivity due to natural processes over time would potentially be adversely affected by the cumulative effects of continued forestry activities. Timber harvest, past placer mining, possible private land development, future mining activities, and continued recreational use also may inhibit fish population increases.

### 3.6.4.11 Regulatory/Forest Plan Consistency

#### *3.6.4.11.1 Endangered Species Act*

All action alternatives may affect and are likely to adversely affect the bull trout and designated bull trout critical habitat. For all alternatives, ESA compliance would be ensured through Section 7 consultation. The KNF will submit a BA to the USFWS that describes the potential effect on threatened and endangered species that may be present in the area. After review of the BA and consultation, the USFWS will issue a biological opinion (BO) for the proposed Montanore Project.

#### *3.6.4.11.2 Kootenai Forest Plan*

**Sensitive Species**

None of the mine or transmission line alternatives would likely contribute to a trend toward federal listing or cause loss of viability of the population of westslope cutthroat trout or interior redband trout. Transmission line construction would result in short-term increases in sedimentation. The transmission line would be removed following mine closure and reclamation, resulting in additional disturbance. BMPs would help minimize the amount of sediment reaching the streams. Identification and implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources would minimize the net effect of the alternatives on sediment concentrations. The reduction in habitat for the interior redband trout in Little Cherry Creek in Alternatives 2 and 4 would not likely contribute to a trend toward federal listing or cause loss of viability of the population. All remaining roads and disturbed areas would be contoured and revegetated following closure of the mine. Any effects from these activities on the aquatic habitat and populations would be minor post-operation. In summary, this effects analysis demonstrates that the effects of implementing the Alternatives 2, 3, or 4 may impact individuals but would not likely contribute to a trend toward federal listing or cause loss of viability of the population of westslope cutthroat trout or interior redband trout.

**Riparian Habitat Conservation Areas**

This section discusses compliance with the following RHCA standards and guidelines:

- Timber management (TM-1)
- Roads management (RF-2 through RF-5)
- Minerals management (MM-1, MM-2, MM-3, and MM-6)

- Lands (LH-3)
- General riparian area management (RA-2 through RA-4)
- Watershed and habitat restoration (WR-1)
- Fisheries and wildlife restoration (FW-1)

*Timber Management (TM-1)*

*Standard*
*Prohibit timber harvest, including fuelwood cutting, in Riparian Habitat Conservation Areas, except as described below:*

*a. Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuelwood cutting in Riparian Habitat Conservation Areas only where present and future woody debris needs are met, where cutting would not retard or prevent attainment of other Riparian Management Objectives, and where adverse effects can be avoided to inland native fish. For priority watersheds, complete watershed analysis prior to salvage cutting in RHCAs.*

*Mine Alternatives*
***Alternative 2.*** Under Alternative 2, the disturbance area for LAD Area 2 would be within a RHCA along Ramsey Creek. Compliance with TM-1 would be achieved through minimizing timber harvest in RHCAs and favoring riparian species and hardwoods.

***Alternatives 3 and 4.*** Alternatives 3 and 4 would comply with TM-1. The disturbance areas for LAD Area 2 would be modified to avoid disturbance of the RHCA along Ramsey Creek.

*Road Management (RF-2)*

*Standard*
*For each existing or planned road, meet the Riparian Management Objectives and avoid adverse effects to inland native fish by:*

*a. completing watershed analyses prior to construction of new roads or landings in Riparian Habitat Conservation Areas within priority watersheds.*

*b. minimizing road and landing locations in Riparian Habitat Conservation Areas.*

*c. initiating development and implementation of a Road Management Plan or a Transportation Management Plan. At a minimum, address the following items in the plan:*

*1. Road design criteria, elements, and standards that govern construction and reconstruction.*

*2. Road management objectives for each road.*

*3. Criteria that govern road operation, maintenance, and management.*

*4. Requirements for pre-, during-, and post-storm inspections and maintenance.*

*5. Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.*

*6. Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control.*

*7. Mitigation plans for road failures.*

*d. avoiding sediment delivery to streams from the road surface.*

*1. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe.*

*2. Route road drainage away from potentially unstable stream channels, fills, and hillslopes.*

*e. avoiding disruption of natural hydrologic flow paths.*

*f. avoiding sidecasting of soils or snow. Sidecasting of road material is prohibited on road segments within or abutting RHCAs in priority watersheds.*

Road width in all new and reconstructed roads would be the minimum necessary to provide for safe and efficient use. The KNF has implemented several actions independent of the Montanore Project to meet RMOs associated with road management. The Libby Ranger District completed a Roads Analysis Report for the Libby Ranger District that established road design criteria, elements, and standards that govern construction and reconstruction and developed management objectives for existing roads. The report provided a descriptive ranking of the problems and risks associated with the current road system, and a list of prioritized opportunities for addressing identified problems and risks (KNF 2005).

*Mine Alternatives*

***Alternative 2.*** MMC would minimize road crossings in RHCAs and would implement BMPs to minimize sediment delivery to crossed streams. All debris removed from the road surfaces except snow and ice would be deposited away from the stream channels. Snow removal would be conducted in a manner to minimize damage to travelways, prevent erosion damage, and preserve water quality. No side casting near stream crossings and bridges would occur, or be implemented as directed by the agencies. Alternative 2 would not be in compliance with RF-2c, because MMC's Plan of Operations does not address all items required by RF-2c. MMC's Plan of Operations also does not address the Libby Creek Road (NFS road #231) that would be used during the evaluation phase, and while the Bear Creek Road was being reconstructed.

***Alternatives 3 and 4.*** Alternatives 3 and 4 would be in compliance with RF-2 because they provide for the development and implementation of a final Road Management Plan. MMC would develop for the lead agencies' approval, and implement a final Road Management Plan that would describe for all new and reconstructed roads the following:

- Criteria that govern road operation, maintenance, and management
- Requirements of pre-, during-, and post-storm inspection and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives
- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control

- Mitigation plans for road failures

The plan would describe management of road surface materials during plowing, such as snow and methods to control road ice. Sidecasting of soils or snow would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs. Culverts along the Bear Creek Road (NFS road #278) and the Libby Creek Road (NFS road #231) that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards, such as fish passage or conveyance of adequate flows.

*Transmission Line Alternatives*
***Alternative B.*** Compliance with RF-2 would be the same as Alternative 2 (see previous discussion in this section). Alternative B would not in compliance with RF-2c, because MMC's Plan of Operations does not address all items required by RF-2c.

***Alternatives C, D, and E.*** Compliance with RF-2 would be the same as Alternatives 3 and 4 (see previous discussion in this section). Alternatives C, D, and E would in compliance with RF-2 because they provide for the development and implementation of a Road Management Plan, as discussed under Alternatives 3 and 4.

*Road Management (RF-3)*

*Standards*
*Determine the influence of each road on the Riparian Management Objectives. Meet Riparian Management Objectives and avoid adverse effects on inland native fish by:*

*a. reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or that have been shown to be less effective than designed for controlling sediment delivery, or that retard attainment of Riparian Management Objectives, or do not protect priority watersheds from increased sedimentation.*

*b. prioritizing reconstruction based on the current and potential damage to inland native fish and their priority watersheds, the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of Riparian Habitat Conservation Areas.*

*c. closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to inland native fish in priority watersheds, and the ecological value of the riparian resources affected.*

***Mine Alternative 2 and Transmission Line Alternative B***. Compliance with RF-3 would be achieved by controlling sediment delivery through BMPs on new roads, reconstructing drainage features on existing roads if necessary, and obliterating and stabilizing roads not needed in the active mining phase after mine closure and removal of the transmission line. Road design features and BMPs designed to INFS riparian goals include chip sealing of the main access road; regular maintenance of unimproved roads; construction of bridges on main stream crossings versus culverts; placement of the tailings pipeline outside any RHCAs; installation of sediment traps and other structures as part of the stormwater and surface water runoff plan; and minimization of any stream activities during road construction (MMI 2006). MMC's Plan of Operations did not address drainage features along the Libby Creek Road (NFS road #231) that would be used while the Bear Creek Road was being reconstructed.

***Mine Alternatives 3 and 4, and Transmission Line Alternatives C, D, and E.*** In mine Alternatives 3 and 4, compliance with RF-3 would be the same as Alternative 2 (see previous paragraph) except as follows. Culverts along the Bear Creek Road (NFS road #278) and the Libby Creek Road (NFS road #231) that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards, such as fish passage or conveyance of adequate flows.

In transmission line Alternatives C, D, and E, compliance with RF-3 would be the same as Alternative B (see previous discussion in this section) except as follows. The status of the transmission line roads on National Forest System lands would be changed to intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. Intermittent stored service roads would require some work to return them to a drivable condition. A culvert on roads used for maintenance access would be installed on any stream flowing at the time of use, if a culvert were not already in place. Intermittent stored service road treatments would include:

- Conducting noxious weed surveys and performing necessary weed treatments prior to storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high risk for blockage or failure; laying back stream banks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch would not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material would not present a future risk to watershed function
- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential

Transmission line roads on National Forest System lands would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. In addition to all of the intermittent stored service road treatments, a decommissioned road would be treated by one or more of the following measures:

- Conducting noxious weed surveys and performing necessary weed treatments prior to decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism

- Removing unstable fills

*Road Management (RF-4)*

*Standard*
*Construct new, and improve existing, culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements would/do pose a substantial risk to riparian conditions. Substantial risk improvements include those that do not meet design and operation maintenance criteria, or that have been shown to be less effective than designed for controlling erosion, or that retard attainment of Riparian Management Objectives, or that do not protect priority watersheds from increased sedimentation. Base priority for upgrading on risks in priority watersheds and the ecological value of the riparian resources affected. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.*

***Mine Alternative 2 and Transmission Line Alternative B***. Mine Alternative 2 and Transmission Line Alternative B would not comply with RF-4. MMC would construct all new bridges on stream crossings to accommodate the 100-year flood, including associated bedload and debris. Crossings would be maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure. Culverts on the Bear Creek Road would be installed or extended as necessary. MMC's Plan of Operations did not address drainage features along the Libby Creek Road (NFS road #231) that would be used during the Libby Adit evaluation program, and while the Bear Creek Road was being reconstructed. On roads for the transmission line, MMC anticipates that no drainage would be provided, but would follow the agencies' guidance if installation of culverts were required.

***Mine Alternatives 3 and 4, and Transmission Line Alternatives C, D, and E***. Mine Alternatives 3 and 4, Transmission Line Alternatives C, D, and E would comply with RF-4. In mine Alternatives 3 and 4, compliance with RF-3 would be the same as Alternative 2 except as follows. Along the Bear Creek Road (NFS road #278) and the Libby Creek Road (NFS road #231), culverts that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards, such as fish passage or conveyance of adequate flows. The development and implementation of a final Road Management Plan in mine Alternatives 3 and 4, and transmission line Alternatives C, D, and E, would include a mitigation plan for road failures at stream crossings. For transmission line roads, culverts on roads would be installed on any stream where channel scour was present, if a culvert were not already in place. Culverts would be sized generally to convey the 100-year storm, but culvert sizing would be determined on a case-by-case basis with the lead agencies' approval of final sizing. When transmission line roads were placed into intermittent stored status, culverts would remain in place unless determined by the KNF to be high-risk for blockage or failure. All culverts would be removed when roads were decommissioned.

*Road Management (RF-5)*

*Standard*
*Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.*

***All Action Alternatives***. Compliance in all alternatives with RF-5 would be the same as RF-4 (see previous discussion).

*Minerals Management (MM-1)*

*Standard*

*Minimize adverse effects to inland native fish species from mineral operations. If a Notice of Intent indicates that a mineral operation would be located in a Riparian Habitat Conservation Area, consider the effects of the activity on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. For operations in a Riparian Habitat Conservation Area ensure operators take all practicable measures to maintain, protect, and rehabilitate fish and wildlife habitat which may be affected by the operations. When bonding is required, consider (in the estimation of bond amount) the cost of stabilizing, rehabilitating, and reclaiming the area of operations.*

***All Action Alternatives***. All mine alternatives would have facilities located in RHCAs. This EIS considers the effects of all alternatives on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. The KNF would share responsibility with the DEQ to monitor and inspect the Montanore Project, and has authority to approve a Plan of Operations that includes all the necessary modifications to ensure that impacts to surface resources would be minimized. These modifications are incorporated into mine Alternatives 3 and 4, and transmission line Alternatives C, D, and E. The KNF and the DEQ would collect a reclamation bond from MMC to ensure that the lands involved with the mining operation are properly reclaimed. The joint reclamation bond would be held by the DEQ to ensure compliance with the reclamation plan associated with the DEQ Operating Permit and the Plan of Operations. The KNF may require an additional bond if it determined that the bond held by the DEQ was not adequate to reclaim National Forest System lands or was administratively unavailable to meet KNF requirements. The KNF and the DEQ would collect a reclamation bond for National Forest System lands affected by the transmission line; the DEQ would collect a reclamation bond for private lands affected by the transmission line.

*Minerals Management (MM-2)*

*Standard*

*Locate structures, support facilities, and roads outside Riparian Habitat Conservation Areas. Where no alternative to siting facilities in Riparian Habitat Conservation Areas exists, locate and construct the facilities in ways that avoid impacts to Riparian Habitat Conservation Areas and streams and adverse effects on inland native fish. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity. Close, obliterate and revegetate roads no longer required for mineral or land management activities.*

***Mine Alternative 2 and Transmission Line Alternative B***. MMC's Alternative 2 and Alternative B would not comply with MM-2. The Ramsey Plant Site would be located in a RHCA. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. The disturbance areas for LAD Area 2 would disturb the RHCA along Ramsey Creek. The lead agencies identified that modification to the LAD Area 2 disturbance area, proposed in mine Alternatives 3 and 4, is a practicable alternative to the LAD Area 2 as proposed in Alternative 2. No alternative to road construction in RHCAs was identified for roads associated with the mine facilities. In all mine alternatives, road construction in RHCAs would be kept the minimum necessary for the approved mineral activity. MMC's Alternative B would locate roads and transmission line structures in RHCAs. The lead agencies' modifications to MMC's proposed alignment and structure placement incorporated into Alternative C, which would reduce the number of roads and transmission line structures in

RHCAs, is a practicable alternative. In Alternative 2 and Alternative B, MMC would close, obliterate and revegetate roads no longer required for mineral or land management activities.

***Mine Alternatives 3 and 4, and Transmission Line Alternative C, D, and E***. These alternatives incorporate modifications and mitigations to MMC's proposals that are alternatives to siting facilities in RHCAs. These alternatives would reduce the number of facilities located in RHCAs. No alternatives exist that eliminate the need to site facilities in RHCAs. These alternatives would minimize effects on RHCAs and inland native fish. Roads no longer required for mineral or land management activities would be placed into intermittent stored service or decommissioned (see INFS standard RF-3).

*Minerals Management (MM-3)*

*Standard*
*Prohibit solid and sanitary waste facilities in Riparian Habitat Conservation Areas. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in Riparian Habitat Conservation Areas exists, and releases can be prevented and stability can be ensured, then:*

*a. analyze the waste material using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics.*

*b. locate and design the waste facilities using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in Riparian Habitat Conservation Areas.*

*c. monitor waste and waste facilities to confirm predictions of chemical and physical stability, and make adjustments to operations as needed to avoid adverse effects to inland native fish and to attain Riparian Management Objectives.*

*d. reclaim and monitor waste facilities to assure chemical and physical stability and revegetation to avoid adverse effects to inland native fish, and to attain the Riparian Management Objectives.*

*e. require reclamation bonds adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities.*

***Mine Alternatives-Plant Site***. The Ramsey Plant Site in Alternative 2 would not comply with MM-3. The Ramsey Plant Site would be located in a RHCA and would be constructed with waste rock. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction.

***Mine Alternatives-Tailings Impoundment***. The tailings impoundment in all mine alternatives would comply with MM-3. Section 2.13.2.4, *Tailings Impoundment* discusses the lead agencies' analysis of alternative tailings disposal methods and locations. Compliance with INFS was a key criterion in the alternatives analysis. The lead agencies developed Alternatives 3 and 4 to minimize the extent to which RHCAs would be affected. Alternatives that would eliminate all effects to RHCAs were not practicable.

The waste material (tailings) has been analyzed using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics. The waste analysis results are discussed in section 3.8, *Geology*. In Alternative 2, during operations MMC would collect representative rock samples from the adits; ore zones; above, below, and between the ore zones; and tailings for static and kinetic testing. In Alternatives 3 and 4, MMC also would collect samples of the lead barren zone, mineralized alteration haloes within the lower Revett, and portions of the Burke and Wallace Formations for static and kinetic testing; assess potential for trace metal release from waste rock; and conduct operational verification sampling within the Prichard Formation during development of the new adits.

Potential acid-generating materials would be segregated for special handling as they were mined and would be placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation. Such locations could include the inner portions of the tailings dam and inside the mine workings. No rock material would be used for construction before determination of its acid-producing potential. In addition, waste rock generated from the underground barren zone would be minimized, to the extent possible, due to higher lead concentrations present in this rock zone, and the greater potential for acid generation. Barren zone waste rock would be segregated from other waste rock and disposed underground.

All waste rock data would be evaluated with water quality monitoring data to determine whether any changes in water quality were the result of acid or sulfate production. Annual reports documenting sample location, sample methods, detection limits, and testing results would be submitted to the lead agencies. Acid-base accounting results would be correlated with lithology and total sulfur analyses.

The tailings impoundment in all mine alternatives would be located and designed using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. Acid generation of the tailings would be unlikely, but tests of metal mobility and monitoring at the Troy Mine suggest that some metals would be mobile in tailings effluent at a near-neutral pH.

Seepage from the impoundment would be minimized by a seepage collection system. In the 1992 and 1993 RODs and the DEQ Operating Permit #00150, the lead agencies required Noranda to modify the impoundment design to minimize seepage from the tailings impoundment to the underlying ground water. As this section discusses, MMC incorporated this requirement into the current tailings impoundment design. A seepage collection system would collect seepage from in and around the tailings impoundment. The collection system would consist of a Seepage Collection Dam and Pond, underdrains beneath the dams and impoundment, blanket drains beneath the dams, and a high-density, polyethylene (HDPE) geomembrane liner beneath portions of the tailings impoundment area (Figure 8 and Figure 9). Pumpback wells would be used, if necessary, to collect tailings impoundment seepage that reached ground water.

MMC has addressed the stability of the tailings impoundment dams through a series of minimum allowable safety factors against failure for static and dynamic loading conditions of the facilities (Klohn Crippen 2005). The factors of safety (FOS) for stability are summarized in section 3.9, *Geotechnical Engineering*. MMC's design criteria are industry design standards for dam design and construction and have been established as measures of certainty for the design of safe earth and rock fill dams.

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Specific objectives are: 1) long-term site stability, 2) protection of surface and ground water, 3) establishment of a self-sustaining native plant community where applicable and possible, 4) wildlife habitat enhancement, 5) protection of the public health and safety, and 6) attaining post-mining land use. The reclamation plan would be revised periodically to incorporate new reclamation techniques and update bond calculations. Prior to temporary or final closure, MMC would submit a revised reclamation plan to the lead agencies for approval.

MMC expects all stockpiled waste rock to be used in various construction activities. It is anticipated that no waste rock would remain at the LAD Area 1 stockpile after cessation of mining operations. Soil removed from this area prior to its use would be replaced and the area revegetated. Waste rock characterization testing would be conducted during mine operations in the event that unanticipated modifications to the reclamation plan were required.

The KNF and the DEQ would require a reclamation bond adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities (see discussion of INFS standard MM-1).

*Minerals Management (MM-6)*

*Standard*
*Develop inspection, monitoring, and reporting requirements for mineral activities. Evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of Riparian Management Objectives and avoid adverse effects on inland native fish.*

***All Action Alternatives***. All action alternatives would comply with MM-6. In Alternative 2 and Alternative B, MMC would follow all inspection, monitoring, and reporting requirements for mineral activities developed by the agencies. MMC would evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of RMOs and avoid adverse effects on inland native fish. In the other action alternatives, the lead agencies have modified the monitoring and reporting requirements to better assess the effects of the proposed project.

*Lands (LH-3)*

*Standard*
*Issue leases, permits, rights-of-way, and easements to avoid effects that would retard or prevent attainment of the Riparian Management Objectives and avoid adverse effects on inland native fish. Where the authority to do so was retained, adjust existing leases, permits, rights-of-way, and easements to eliminate effects that would retard or prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. If adjustments are not effective, eliminate the activity. Where the authority to adjust was not retained, negotiate to make changes in existing leases, permits, rights-of-way, and easements to eliminate effects that would prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. Priority for modifying existing leases, permits, rights-of-way, and easements would be based on the current and potential adverse effects on inland native fish and the ecological value of the riparian resources affected.*

***All Transmission Line Alternatives***. All transmission line alternatives would comply with LH-3. The KNF issuance of any permit or approval associated with the Montanore Project would avoid effects that would retard or prevent attainment of the RMOs and avoid adverse effects on inland native fish.

***Alternative B.*** Alternative B would comply with LH-3. Compliance with LH-3 would be achieved through minimizing vegetation clearing and adverse effects in RHCAs through the use of steel monopoles, which would require a clearing area up to 150 feet. Clearing associated with Alternative B would occur outside RHCAs, if possible. If clearing were necessary in an RHCA, effects would be minimized through use of appropriate BMPs.

***Other Transmission Line Alternatives.*** The other transmission line alternatives would comply with LH-3. Structure type in Alternatives C, D, and E would be H-frame wooden poles (except for a short segment on Alternative E), which would require a clearing area up to 200 feet. Wooden H-frame structures generally allow for longer spans and require fewer structures and access roads in RHCAs. Structures would be installed using a helicopter to minimize road construction and vegetation clearing in RHCAs. Disturbance and vegetation clearing in RHCAs at stream crossings would be minimized through implementation of a Vegetation Clearing and Disposal Plan. As mitigation, MMC would leave large woody material for small mammals and other wildlife species within the cleared transmission line corridor on National Forest System lands.

*General Riparian Area Management (RA-2)*

*Standard*
*Trees may be felled in Riparian Habitat Conservation Areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.*

***All Action Alternatives***. Timber harvest in RHCAs in LAD Area 2 in Alternative 2 is discussed in the previous INFS standard TM-1. Trees cleared in RHCAs for the transmission line would be limited to those that pose a safety risk. Developing and implementing a Vegetation Removal and Disposition Plan, minimizing heavy equipment use in RHCAs (Environmental Specifications, Appendix D), and using helicopters for structure placement and vegetation clearing in Alternatives C, D, and E would minimize clearing and disturbance in RHCAs. Alternatives C, D, and E would comply with RA-2.

*General Riparian Area Management (RA-3)*

*Standard*
*Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.*

***All Action Alternatives***. All action alternatives would comply with RA-3. In Alternative 2 and Alternative B, measures outlined in MMC's Weed Control Plan approved by the Lincoln County Weed Control District would be followed during operations and reclamation. All herbicides used in the analysis area would be approved for use in the KNF, and would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity, and public health and safety. In the other action alternatives, MMC also would implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007) for all weed-control measures. These measures would ensure that herbicides, pesticides,

and other toxicants, and other chemicals were used in a manner that would not retard or prevent attainment of RMOs and would avoid adverse effects on inland native fish.

*General Riparian Area Management (RA-4)*

*Standard*
*Prohibit storage of fuels and other toxicants within Riparian Habitat Conservation Areas. Prohibit refueling within Riparian Habitat Conservation Areas unless there are no other alternatives. Refueling sites within a Riparian Habitat Conservation Area must be approved by the Forest Service or Bureau of Land Management and have an approved spill containment plan.*

***Mine Alternatives***. MMC's Alternative 2 would not comply with RA-4. Fuel storage at the Ramsey Plant Site would be about 150 feet from Ramsey Creek, within the Ramsey Creek RHCA. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. Fuel storage at the Libby Plant site would not be within a RCHA. MMC's Spill Response Plan provides a spill containment and response plan. Alternatives 3 and 4 would comply with RA-4.

*Watershed and Habitat Restoration (WR-1)*

*Standard*
*Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species and contributes to attainment of Riparian Management Objectives.*

***All Action Alternatives***. All action alternatives would comply with WR-1. The fisheries mitigation proposed in Alternative 2 was developed in 1993 during the permitting of the original Montanore Project, and does not focus on bull trout or designated bull trout critical habitat. RMOs were not in place in 1993. Mine Alternatives 3 and 4 propose instream rehabilitation and structures as mitigation to meet RMOs and improve conditions for native fish.

*Fisheries and Wildlife Restoration (FW-1)*

*Standard*
*Design and implement watershed fish and wildlife habitat restoration and enhancement actions in a manner that contributes to attainment of the Riparian Management Objectives.*

***All Action Alternatives***. The mitigation proposed in mine Alternatives 3 and 4 would comply with FW-1. About 43 miles of proposed access changes and either placing roads into intermittent stored service or decommissioning them would reduce sediment to area creeks and contribute to attainment of the RMOs.

#### 3.6.4.12 Short- and Long-Term Effects

Short-term effects of construction and operation of the project in Alternative 2 would include potential increases in sedimentation within the Libby Creek drainage. Alternatives 3 and 4 are predicted to include fewer changes in sedimentation in the Libby Creek drainage. While all of the transmission line alternatives pose some risk of increased sedimentation in analysis area streams, Alternative C represent the lowest risk of sediment effects from the transmission line. The predicted change in sedimentation rates with these alternatives likely would have few, if any, effects on fish populations, and these effects would be short-term because annual snowmelt runoff can flush accumulated fine sediments downstream.

Long-term effects of the project would include a permanent loss of 13,000 feet of the pure redband habitat in Little Cherry Creek due to the construction of the tailings impoundment and diversion channel in Alternative 2, and a similar loss of habitat in Alternative 4. This loss of habitat would adversely affect the pure redband trout population that currently exists in Little Cherry Creek. Although not specifically aimed at mitigation for pure redband trout populations, habitat improvement and mitigation measures included (in varying extent) in Alternatives 2, 3, and 4 would result in restoration of stream habitat and recreational access lost due to the development of the diversion channel and other mine facilities.

Water quality in the analysis area would improve over time during operations, but may not return to pre-mine conditions and, if not, would continue to adversely affect the biotic communities due to:

- Water quality changes that may occur due to loss of a deep ground water supply to streams, springs, and lakes
- Water quantity changes in streams that would occur in Alternatives 2 and 4 due to the diversion of Little Cherry Creek

Decreases in flow in Libby Creek, Ramsey Creek, Rock Creek, and the East Fork Bull River are predicted to occur for all action alternatives during mine operations. After the mine void filled (about 70 years after mining), flow in these streams would increase compared to flow during operations, but may not return to pre-mine conditions. If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow. Flow changes may not be measurable or separable from natural flow variability, but any decrease in flow could have adverse long-term effects on the bull trout and westslope cutthroat trout populations in these streams by decreasing available habitat in the headwaters of these streams during certain times of the year. Bull trout may be particularly affected by these decreases because the habitat loss would occur during their spawning period. Additionally, the East Fork Bull River is considered one of the most important bull trout spawning streams in the lower Clark Fork River drainage. The Little Cherry Creek diversion would reduce the available habitat by 13,000 feet for the pure redband populations in Little Cherry Creek using Alternatives 2 and 4.

Habitat restoration efforts would be included in Alternatives 2, 3, and 4 and would provide mitigation for the loss of trout habitat in Little Cherry Creek by restoring portions of Libby Creek or other streams within the drainage.

### 3.6.4.13 Irretrievable and Irreversible Commitments

The Little Cherry Creek diversion would reduce available habitat by 13,000 feet for the small, pure redband population in Little Cherry Creek in Alternatives 2 and 4. The agencies' analysis assumed the engineered diversion channel would not provide any fish habitat, while the two channels would eventually provide marginal fish habitat for both redband trout and bull trout.

Alternatives 2 and 4 could result in an irreversible loss of genetic diversity from the redband trout found in Little Cherry Creek if efforts to collect fish from the affected segment of Little Cherry Creek to be transferred to the diversion drainage were not entirely successful. Additionally, the loss of habitat in Little Cherry Creek could result in a decrease in redband populations in that stream with these alternatives. Hybridization of the pure redband trout population in Little Cherry

Creek is unlikely to occur in Alternative 3, but may occur in Alternatives 2 and 4 if barriers did not develop in the diversion drainage as predicted and the redband trout come in contact with non-native trout in the Libby Creek drainage. Increased sedimentation within the Libby Creek drainage also could adversely affect redband and bull trout populations. Habitat restoration efforts would be included in Alternative 2, and to a greater extent in Alternatives 3 and 4, and would provide mitigation for the loss of trout habitat in Little Cherry Creek by restoring portions of Libby Creek or other streams within the drainage.

Adverse effects from increased sedimentation rates may occur to redband and bull trout populations and designated bull trout critical habitat with Alternative B. Sedimentation effects would be less with the other transmission line alternatives.

Alternatives 2, 3, and 4 could result in an irreversible reduction of bull trout and westslope cutthroat trout habitat in Rock Creek drainage due to decreases in flow. If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow. Loss of bull trout habitat in the East Fork Bull River in Alternative 2 could be detrimental to bull trout populations in the lower Clark Fork River because this stream is considered a primary spawning location in this system. The completion of the habitat inventory and construction of instream structures forming pools and deep water habitat would improve the bull trout habitat in the East Fork Bull River.

### 3.6.4.14 Unavoidable Adverse Environmental Effects

Based on the agencies' conceptual model of the connection of surface and ground water in the analysis area, mining of the ore body would unavoidably reduce streamflows and spring flows, and affect lake levels in surface water located above the ore body, but below an elevation of about 5,600 feet. Decreased base flow would result in the loss of aquatic habitat. Sediment loading to the analysis area streams would increase due to erosion from mine facility and transmission line construction.

# 3.7 Cultural Resources

## 3.7.1 Regulatory Framework

Section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended (16 U.S.C. 470, *et seq.*) and its implementing regulations under 36 CFR 800 require all federal agencies to consider effects of federal actions on cultural resources eligible for or listed in the National Register of Historic Places (NRHP). Both listed and potentially eligible properties must be considered during Section 106 review. In the Section 106 Review, the Forest Service considers effects to cultural resource properties within the area of potential effect (APE). The APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist (36 CFR 800.16)."

Traditional cultural properties (TCPs) are protected under Section 106 of the NHPA; the American Indian Religious Freedom Act of 1978 (AIRFA); and the Native American Grave Protection and Repatriation Act of 1990 (NAGPRA). A TCP may be eligible for listing in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in the history of the community or tribe and, (b) are important in maintaining the continuing cultural identity of the community or tribe. Effects on American Indians have been discussed in section 3.5, *American Indian Consultation*.

Generally, any site of human activity older than 50 years is considered to be a potential cultural resource. The NHPA requires federal agencies to identify any cultural resource properties that might be affected by a federal undertaking. An undertaking refers to any federal action, such as approval of a Plan of Operations for the Montanore Project. If the cultural resource is affiliated with American Indian use, then consultation with tribes who have cultural affiliation with the site begins. Once identified, a cultural resource property is formally evaluated by the KNF in consultation with the SHPO, to determine whether the property is eligible for listing on the NRHP.

After consultation, the SHPO provides a determination of eligibility for each cultural resource affected by the project. If the property is found to be eligible, the KNF will determine whether the property would be adversely affected by the undertaking. Cultural resources that remain eligible for listing in the NRHP and that cannot be avoided during project implementation would be considered adversely affected. When adverse effects are anticipated, MMC may choose to redesign the project to avoid the property. If avoidance is not feasible, actions will be taken to mitigate any adverse effects to the property. A mitigation plan will be developed by MMC, reviewed by the KNF, reviewed by culturally affiliated tribes, and approved by the SHPO and the Advisory Council on Historic Preservation.

The location of cultural resource sites is exempt from public disclosure under Public Law 94-456. The purpose of this exemption is to protect a site from potential vandalism and to retain confidentiality of sites culturally significant to American Indian tribes. Similar state laws governing cultural resources are found in 22-3, MCA.

## 3.7.2 Analysis Area and Methods

The APE includes all mine-related facilities and four transmission line alternatives, each with a 500-foot buffer. The buffer areas are included in the analysis of direct, indirect, and cumulative effects. No formal consultation has taken place between the KNF and the SHPO regarding definition of the APE, but consultation is expected to take place prior to project implementation.

Cultural resources were identified within the APE using three methods:

- A Class I file and literature review with the SHPO and the KNF by Historical Research Associates (Historical Research Associates 2006a, 2006b) to identify previous cultural resource inventories and archaeological sites within the APE
- A Class III intensive pedestrian cultural resource inventory was conducted within all mine facility footprints, including portions of the APE that are on private land (Historical Research Associates 1989a, 1989b, 1989c, 1990, 2006a, 2006b)
- Shovel testing areas identified by the KNF as medium to high probability areas for cultural resources, in addition to pedestrian survey (Historical Research Associates 2006a, 2006b)

Mine facility areas proposed in Alternative 2 (*i.e.*, Little Cherry Creek Tailings Impoundment Site, LAD Areas 1 and 2, Ramsey Plant Site, and Libby Adit Site) were inventoried at an intensive level, including shovel testing in areas of low ground visibility (Historical Research Associates 2006a; 2006b. Previous inventory conducted for Noranda included portions of proposed facility locations (Historical Research Associates 1990). Once project engineering has been finalized, additional inventory would be required to satisfy Section 106 requirements. Of the transmission line alternatives, only segments of the North Miller Creek, Modified North Miller Creek, and Miller Creek Alternatives have been subject to intensive inventory (Historical Research Associates 1990; 2006b). Effects to cultural resources were evaluated using GIS spatial analysis to compare the location of cultural resources in relation to proposed project facilities. Because not all of the proposed transmission line alternatives were inventoried for cultural resources, only those cultural resources identified through the file and literature review were considered in the effect analysis. Once a final transmission line alignment has been chosen, any remaining pedestrian inventory and/or exploratory shovel testing would be conducted to comply with Section 106 of the NHPA and 22-3, MCA. If previously unknown cultural or historical resources were discovered during any remaining inventory, MMC would avoid disturbing the sites and their setting as recommended after consultation with SHPO and as allowed by the landowner.

## 3.7.3 Affected Environment

### 3.7.3.1 Cultural Resource Overview

The following cultural overview is summarized from a synthesis provided by Historical Research Associates (1989a; 1989b; 1990; 2006a; 2006b). At the time of Euro-American contact, two major ethnic groups occupied and used areas that include the current analysis area. The Kalispell or Lower Pend d'Oreille occupied the Clark Fork River drainage from the area around Lake Pend d'Oreille in Idaho to the vicinity of Plains, Montana. The Kootenai (also spelled Kutenai) occupied the area drained by the Kootenai River in Montana and the Kootenay and upper Columbia rivers in British Columbia. They occupied semi-permanent winter encampments and

seasonally exploited other sites. The Kootenai, who subsisted on a hunting-gathering economy based primarily on fish, big game and camas, have used the analysis area for the last three to five centuries.

The most salient prehistoric data come from the work conducted at the Libby Dam and Reservoir area. Work from this area established clear continuity between prehistoric use of the area and the historic Kootenai. The spatial extent of the Kootenai, and by extension most other groups in the region, was considerable due to seasonal mobility between the mountains and plains as a means of successful adaptation. It is likely that the Kootenai split into smaller groups early in the Common Era, each relying more heavily on either plains or mountain-based resources, depending on their location, while using extensive trade networks.

The first contact between Native Americans and Euro-Americans in the area was initiated by explorers and fur traders. The first Euro-Americans to enter the analysis area were LeGasse and LeBlanc, employees of the Northwest Company sent into the region in 1801. Jaco Finley crossed the Rocky Mountains via Howse Pass in 1806 and David Thompson arrived in the Libby area in May, 1808; his travels are described in journals dated 1808-1812. Several trading posts were established in the region and travel routes such as the "Kootenai Road" became important links to connect the Kootenai River region with the trading posts.

More permanent Euro-American settlements resulted from the influx of people during the gold strikes of the 1860s and the construction of the transcontinental railroads through the Clark Fork Valley in 1883 and the Kootenai Valley in 1892. There was placer mining and an established mining camp along Libby Creek by 1867-1868. The initial rush to Libby Creek included 500 to 600 men, but the number quickly diminished to a handful by early 1868. The camp was referred to as Libbysville. Little to no placer mining took place during 1876 to 1885 when a small rush resumed after gold was once again discovered. Settlement along the Kootenai River was limited to the town of Tobacco Plains until the late 1880s, when Old Town or Lake City was established near with the mouth of Ramsey Creek on upper Libby Creek. The Thompson Falls to Libby Creek Trail was extended to Old Town and a general store existed to supply goods. Old Town was abandoned in 1889 with the establishment of Old Libby, which in turn was abandoned in 1891 when the Howards, among others, established ranches near the mouth of Libby Creek in anticipation of the Great Northern Railroad route to be established closer to the Kootenai. Placer mining in the Libby Creek drainage peaked in the early 1900s. Both railroads and mining contributed to the development of the timber industry, which became the economic base in both Lincoln and Sanders counties.

A major change in the region resulted from the establishment of the Forest Reserves, later known as National Forests. Lands within the reserves came under the administration and protection of the federal government, and timber cutting became regulated. Portions of the land within the analysis area were included in the Cabinet Forest Reserve, now part of the Libby and Cabinet Ranger Districts of the KNF.

#### 3.7.3.2 Archaeological Resource Potential

Based on sites recorded in the region, and a synthesis of expected cultural resources provided in the KNF Heritage Guidelines (KNF 2002), the following cultural resource types were considered most likely to occur in the analysis area: prehistoric campsites, scarred trees, historic cabins, trading posts, mining and logging sites, homesteads, bridges, and trash dumps. Cultural resources in upland areas are expected to be fewer than in lower elevation areas and along major water

courses. Upland areas were used seasonally by hunter-gatherer groups for specific economic procurement tasks and, as such, the cultural imprints from these activities are expected to be less visible than long-term habitation sites located at lower elevations (KNF 2002). Identification of specialized economic activity sites expected in upland areas is difficult because of the limited material assemblage associated with this type of site and the extensive vegetation cover of the analysis area. Subsurface testing was used in high-probability areas to locate cultural resources.

### 3.7.3.3 Recorded Cultural Resources

#### *3.7.3.3.1 Mine Facilities*

The file and literature review and inventory of mine related facilities determined that 20 cultural resources have been previously recorded within the APE (Table 69 and Table 70). Four potential resources are known but have not been formally recorded (North Fork of the Miller Creek Trail, the Libby Divide Trail, and site leads FS D5-241SL and D5-363). The two trails are considered significant resources under a 1997 Programmatic Memorandum of Agreement (PMOA) signed between the KNF, the SHPO, and the Advisory Council on Historic Preservation.

Known cultural resources in mine facility areas (Table 69) are six officially eligible sites, two field not eligible sites, one field eligible site, and one site that has not been evaluated. Most significant is site 24LN1323, the Libby Mining District (District), which encompasses most of the mine facility areas and the northwest terminus of the transmission line alternatives. This site is a NRHP eligible historic district that embodies the physical features of mining from 1867 to the 1950s and a visual aspect that conveys both setting and location criteria. Six of the sites are related to the District and are considered contributing elements of the District. Sites 24LN320, known as the Comet Placer, 24LN1677 (Beager Cabin), and 24LN1678 (unnamed cabin) are officially eligible for the NRHP as contributing elements to the District. Sites 24LN943 and 24LN980 are listed as not eligible as contributing elements of the District, and site 24LN1209, the Old Libby Wagon Road, is considered a contributing element to the District. Sites 24LN320 and 24LN1209 are located within the Little Cherry Creek Tailings Impoundment Site (Alternatives 2 and 4) and are officially eligible for the NRHP. Site 24LN943 is a historic logging camp originally recommended as not eligible, and has since been destroyed by previous construction associated with the Libby Adit (private property). Site 24LN1680 is believed to be a portion of a placer mine that extends about 100 feet into the Libby Adit facility. It is currently unknown what elements of this resource, if any, actually extend into the APE.

The KNF has identified an additional four cultural resources and two unrecorded sites that may be affected by proposed fishery mitigation work associated with Alternative 2. These include sites 24LN1677 and 24LN1678, both of which are contributing elements to the Libby Mining District (24LN1323); site 24LN2203, a prehistoric site with an unknown eligibility status; an unrecorded feature of 24LN980 (historic dam) that has an unresolved eligibility status; and site leads D5-241SL and D5-363 that require documentation and evaluation prior to project implementation.

**Table 69. Known Cultural Resources within Mine Facility Areas.**

| Smithsonian Site # | Site Type | NRHP Eligibility | Area of Potential Effect |
|---|---|---|---|
| *24LN320 | Historic mining features - Comet Placer | Officially Eligible | Little Cherry Creek Tailings Impoundment Alternatives 2 and 4 |
| *24LN943 | Logging camp | Field Not Eligible (destroyed) | Libby Adit All Alternatives |
| *24LN980 | Dam | Field Not Eligible | Alternative 2 – Proposed Mitigation Area |
| *24LN1209 | Historic road/trail – Libby Wagon Road | Officially Eligible | Little Cherry Creek Tailings Impoundment Alternatives 2 and 4 |
| 24LN1323 | Libby Mining District | Officially Eligible | All project components except Libby Adit |
| *24LN1677 | Beager Cabin | Officially Eligible | Alternative 2 – Proposed Mitigation Area |
| *24LN1678 | Cabin | Officially Eligible | Alternative 2 – Proposed Mitigation Area |
| 24LN1680 | Placer Mine (linear) | Officially Eligible | Libby Adit (100 feet according to GIS) All Alternatives |
| 24LN2203 | Prehistoric | Field Eligible | Alternative 2 – Proposed Mitigation Area |
| FS D5-241SL | Mining features and cabin | Not Evaluated | Alternative 2 – Proposed Mitigation Area |
| FS D5-363 | Mining camp | Not Evaluated | Alternative 2 – Proposed Mitigation Area |

*Contributing cultural resources to the Libby Mining District (24LN1323).

#### *3.7.3.3.2 Transmission Line Alignments*

Known cultural resources located within the four transmission line corridor alternatives are listed in Table 70. Cultural resources common to all transmission line alternatives include 24LN208, 24LN722, 24LN1323 (Libby Mining District), and the Libby Divide and Miller Creek Trails. Site 24LN208 (Trail #6) crosses all alternatives north of the Sedlak Substation where the alignment parallels U.S. 2. Site 24LN722 was recorded within the area proposed for the Sedlak Substation, but was unable to be relocated by Historical Research Associates during recent inventory efforts. Historical Research Associates assumed the scarred tree that comprised this resource had been logged and no longer exists. The Libby Divide and North Fork of the Miller Creek Trail is a system of trails crossed by all transmission line alternatives except the West Fisher Alternative (Historical Research Associates 2006a, 2006b).

Site 24LN720 is a multi-component historic mining and prehistoric campsite located within the buffer area of Alternative E. The site is officially eligible for the NRHP. Site 24LN962 is the Teeter Peak Trail that crosses Alternatives D and E and is recommended field not eligible. Site

24LN963 is an unnamed historic road/trail that crosses Alternative E, which is also recommended field not eligible. Site 24LN1584 includes two culturally modified trees located within the buffer area of Alternative B. Similarly, site 24LN1585 includes four culturally modified trees within Alternatives B, C, and D. Both sites are recommended field eligible. Site 24LN1818 is a portion of U.S. 2 that crosses Alternatives B, C, and D. Because of the ongoing modification that the highway receives, the resource has not been evaluated for the NRHP.

**Table 70. Cultural Resource Sites Located within the Transmission Line Alternatives.**

| Smithsonian Site # | Site Type | NRHP Eligibility | Area of Potential Effect |
|---|---|---|---|
| 24LN208 | Trail #6 | Field Not Eligible | All Alternatives |
| 24LN720 | Historic Mining and Prehistoric campsite | Officially Eligible | Alternative E |
| 24LN722 | Scarred Tree | Undetermined (destroyed) | All Alternatives (Sedlak Substation area) |
| 24LN962 | Teeter Peak Trail | Field Not Eligible | Alternatives D and E |
| 24LN963 | Historic road/trail | Field Not Eligible | Alternative E |
| 24LN1323 | Libby Mining District | Officially Eligible | All Alternatives (no contributing elements affected) |
| 24LN1584 | Two scarred trees | Field Eligible | Alternative B |
| 24LN1585 | Four scarred trees | Field Eligible | Alternatives B, C, and D |
| 24LN1818 | Portions of U.S. 2 | Not Evaluated | Alternatives B, C, and D |
| FS D5-122 | North Fork Miller Creek Trail #505 | Avoidance per 1997 PMOA | All Alternatives |
| FS D5-126 | Libby Divide Trail #716 | Avoidance per 1997 PMOA | All Alternatives |

## 3.7.4 Environmental Consequences

### 3.7.4.1 Alternative 1 – No Mine

No direct, indirect, or cumulative effects would occur to cultural resources in Alternative 1. Natural weathering, deterioration, and vandalism of cultural resources would continue. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

### 3.7.4.2 Alternative 2 – MMC's Proposed Mine

All 11 cultural resources identified within mine facilities would be affected by Alternative 2 (Table 69) and remain potentially eligible for listing in the NRHP. Five of these resources may be impacted by proposed fishery mitigation areas and are discussed separately below. Site 24LN1323, the Libby Mining District, would be affected by all Alternative 2 facility components except construction of the Libby Adit site. The District includes an extensive area where placer

mining took place, including locations along drainages of Libby, Big Cherry, Midas, Bear, Poorman, Ramsey, Little Cherry, and Howard creeks. Mitigation would be necessary for those areas of the District that would be adversely affected by facility construction. Mitigation for the District could include formal documentation under the USDI National Park Service's Cultural Landscapes Program. The type of data recovery necessary for cultural landscapes would be determined from a data recovery plan developed in consultation with the KNF and the SHPO.

Site 24LN320 is located on private land within the Little Cherry Creek Tailings Impoundment Site and is individually officially eligible for the NRHP, as well as being a contributing element to the Historic District. The KNF recommends that additional recording is necessary in addition to potential data recovery efforts of known site components. Mitigation plans for sites 24LN320 and 24LN1209, also located within the Little Cherry Creek Tailings Impoundment Site, would need to be developed in consultation with the SHPO and could include Level II HAER documentation for site 24LN1209 and/or HABS documentation for site 24LN320 depending on the type of mining features present. Review and consultation with SHPO is required for site 24LN943 in order to receive a consensus determination of not eligible based on the loss of physical integrity of the site. Assuming concurrence from the SHPO, no additional work would be required. Additional fieldwork would be necessary for site 24LN1680 to determine what portion, if any, of this site actually extends into the footprint of the Libby Adit Site. If the site were found to extend into the Libby Adit facility footprint, a data recovery plan would need to be developed. Depending on the nature of the features that would be adversely affected, HAER documentation would be the likely mitigation.

Alternative 2 also includes proposed fishery mitigation work around Howard Lake and Libby Creek, which may have the potential to adversely affect five cultural resources. Trail paving associated with mitigation activities around Howard Lake has the potential to adversely affect site 24LN2203. The Forest Service has recommended that mitigation be implemented prior to ground disturbance, which could include either protective covering or data recovery. Rehabilitation efforts associated with Libby Creek have the potential to adversely affect three cultural resource sites (24LN980, 24LN1677, and 24LN1678) and two unrecorded sites (D5-241SL and D5-363). An unrecorded feature of 24LN980 would require documentation and evaluation as a potential contributing element of the District (24LN1323). The historic cabins officially eligible (24LN1677 and 24LN1678) would require HABS documentation if adversely affected by fishery mitigation activities. Review and consultation also would be required for site 24LN980 in order to receive a consensus determination of not eligible. This site also would need to be evaluated as to whether it contributes to the District. If the site were not eligible either individually or as a contributing element to the District, no additional work would be required. If the site were a contributing element to the District, a data recovery plan would need to be developed and could include HAER documentation. The two unrecorded sites (D5-241SL and D5-363) would need to be formally documented and evaluated for effects from the proposed mitigation activities. The KNF has recommended that sites 24LN980, 24LN1677, and 24LN1678, and the two unrecorded sites be considered for interpretation to benefit the public.

For those sites with unresolved eligibility status (24LN943, 24LN980, 24LN2203, D5-363, and D5-241SL), review and consultation with SHPO would be necessary prior to ground disturbing activities. For those cultural resources found to be eligible for listing in the NRHP following consultation, a data recovery plan would need to be developed in consultation between the Forest Service, the SHPO and, if necessary, the tribes. Finally, for those sites with consensus eligible determinations (24LN320, 24LN1209, 24LN1323, 24LN1677, and 24LN1678), data recovery

plans would need to be developed in consultation between the Forest Service, the SHPO and, if necessary, the tribes.

#### 3.7.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Effects to cultural resource sites 24LN1323, 24LN1680, and 24LN943 are the same as described under Alternative 2. Alternative 3 would not directly affect any other cultural resources. Cultural resources in the analysis area may see increased vandalism, artifact collecting, and inadvertent physical disturbance as a result of increased human activity and accessibility to the sites over the life of the mine.

#### 3.7.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Effects to cultural resource sites 24LN320, 24LN943, 24LN1209, 24LN1323, and 24LN1680 are the same as described under Alternative 2. Alternative 4 would not directly affect any other cultural resources. Cultural resources in the analysis area may see increased vandalism, artifact collecting, and inadvertent physical disturbance as a result of increased human activity and accessibility to the sites over the life of the mine.

#### 3.7.4.5 Alternative A – No Transmission Line

No direct, indirect, or cumulative effects in the transmission line corridors would occur to cultural resources in Alternative A. Natural weathering, deterioration, and vandalism would continue.

#### 3.7.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Eight cultural resources are located within the North Miller Creek Transmission Line (Alternative B) alignment and 500-foot buffer area (Table 70). Affected sites would be 24LN208, 24LN722, 24LN1323, 24LN1584, 24LN1585, 24LN1818, and Forest Trails 505 and 716. Effects to site 24LN1323 and potential mitigation efforts have been discussed under Alternative 2.

Site 24LN722 was once located within the proposed Sedlak Substation facility. Fieldwork determined that logging operations have removed the tree (Historical Research Associates 2006a). The North Miller Creek Alternative would cross site 24LN208 north of the Sedlak Substation location. Sites 24LN1584 and 24LN1585 are both culturally scarred tree locations within the 500-foot buffer area of the alignment; both have an eligibility status of field eligible. If the sites are determined eligible, they would be either avoided or a data recovery plan developed. Preliminary field review indicates they could be avoided by flagging and appropriate pole placement. Other trees would be preserved in the general location, if possible, to maintain integrity of setting and location. Site 24LN1818 remains unevaluated for the NRHP due to the ongoing modifications that the highway receives.

Although considered significant under the 1997 PMOA, Forest Trails 505 and 716 (the North Fork of the Miller Creek Trail and Libby Divide Trail, respectively) would be formally recorded and evaluated for the NRHP. If determined eligible, a plan would be necessary to mitigate adverse effects. If feasible, vegetation clearing for the transmission line would be conducted in a manner that maintains integrity of setting and location. Pole placement also would be designed to avoid or minimize effects on the trails.

Review and consultation with the SHPO would be necessary for sites 24LN722, 24LN208, 24LN1584, and 24LN1585 in order to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary to complete evaluation prior to SHPO consultation. Because effects would entail crossing of an overhead transmission line with no direct effects, a determination of no adverse effect may be achieved through consultation. For those cultural resources determined to be ineligible for the NRHP, no additional work would be necessary.

#### 3.7.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

Effects to cultural resource sites 24LN208, 24LN722, 24LN1323, 24LN1585, and 24LN1818, and Forest Trails 505 and 716 and proposed mitigation would be the same as described under Alternative B.

#### 3.7.4.8 Alternative D – Miller Creek Transmission Line Alternative

Effects to cultural resource sites 24LN208, 24LN722, 24LN1323, and 24LN1585 and proposed mitigation would be the same as described under Alternative B. Alternative D would cross the Teeter Peak Trail (24LN962), which has an unresolved eligibility status of not eligible. Review and consultation with the SHPO would be necessary to receive a consensus determination prior to project implementation.

#### 3.7.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

Effects to cultural resource sites 24LN208, 24LN722, and 24LN1323 and proposed mitigation would be the same as described under Alternative B. Alternative E would cross both the Teeter Peak Trail (24LN962) described under Alternative D and an unnamed historic road/trail (24LN963) that has an unresolved eligibility status of not eligible. If Alternative E were selected, both sites 24LN962 and 24LN963 would be reviewed by the SHPO in order to receive a consensus determination. Site 24LN720 is multi-component historic mining and prehistoric campsite that is officially eligible for the NRHP. It was not included in Historical Research Associates' file and literature review because it was not under consideration as an alternative at the time of Historical Research Associates' review. Direct effects to this site may be avoided by proper pole placement and a protective cover of vegetation to maintain integrity of setting.

#### 3.7.4.10 Summary of Effects

The effects of the mine alternative are summarized in Table 71; Table 72 summarizes the effects of the transmission line alternatives. The number of cultural resources affected under each alternative is:

- Alternative 2—10 cultural resources
- Alternative 3—3 cultural resources
- Alternative 4—5 cultural resources
- Alternative B—8 cultural resources
- Alternative C—7 cultural resources
- Alternative D—8 cultural resources
- Alternative E—8 cultural resources

**Table 71. Summary of Effects of Mine Alternatives on Cultural Resources within the Area of Potential Effect and Potential Mitigation.**

| Site | Alternative | Type | NRHP Status | SHPO Consultation Necessary | Potential Mitigation |
|---|---|---|---|---|---|
| 24LN320[†] | Mine Alternatives 2 and 4 | Historic Mining features - Comet Placer | Officially Eligible | No | HABS/HAER |
| 24LN943[†] | All mine action alternatives | Logging Camp | Field Not Eligible (destroyed) | Yes | No Further Work |
| 24LN980[†] | Mine Alternative 2 | Dam | Field Not Eligible | Yes | Pending Consultation |
| 24LN1209 | Mine Alternatives 2 and 4 | Historic road/trail –Libby Wagon Road | Officially Eligible | No | HAER |
| 24LN1323 | All mine action alternatives | Libby Mining District | Officially Eligible | No | NPS Cultural Landscapes Program |
| *24LN1677 | Mine Alternative 2 | Beager Cabin | Officially Eligible | No | HABS |
| *24LN1678 | Mine Alternative 2 | Cabin | Officially Eligible | No | HABS |
| 24LN1680 | All mine action alternatives | Placer Mine (linear) | Officially Eligible | No | HAER |
| 24LN2203 | Mine Alternative 2 | Prehistoric | Field Eligible | Yes | Protective Covering or Data Recovery (excavation) |
| FS D5-241SL | Mine Alternative 2 | Mining features and cabin | Not Evaluated | Yes | Pending Consultation |

**Table 72. Summary of Effects of Transmission Alternatives on Cultural Resources within the Area of Potential Effect and Potential Mitigation.**

| Site | Alternative | Type | NRHP Status | SHPO Consultation Necessary | Potential Mitigation |
|---|---|---|---|---|---|
| 24LN1323 | All transmission line alternatives | Libby Mining District | Officially Eligible | No – eligibility<br>Yes – mitigation plan | NPS Cultural Landscapes Program |
| 24LN208 | All transmission line action alternatives | Trail #6 | Field Not Eligible | Yes – concurrence | No Further Work |
| 24LN720 | Transmission Alternative E | Historic Mining and Prehistoric campsite | Officially Eligible | No – eligibility<br>Yes – mitigation plan | Avoidance (HABS/HAER and/or Data Recovery (excavation)) |
| 24LN722 | All transmission line action alternatives | Scarred Tree | Undetermined | Yes – eligibility | Avoidance (Pending Consultation) |
| 24LN962 | Transmission line Alternatives D and E | Teeter Peak Trail | Field Not Eligible | Yes – concurrence | No Further Work |
| 24LN963 | Transmission Alternative E | Historic road/trail | Field Not Eligible | Yes – concurrence | No Further Work |
| 24LN1584 | Transmission Alternative B | Two scarred trees | Field Eligible | Yes – concurrence and mitigation plan | Avoidance |
| 24LN1585 | Transmission Alternatives B, C, and D | Four scarred trees | Field Eligible | Yes – concurrence and mitigation plan | Avoidance |
| 24LN1818 | Transmission Alternatives B, C, and D | Portions of U.S. 2 | Not Evaluated | Yes – eligibility | Pending Consultation |
| FS D5-122 | All transmission line action alternatives | North Fork Miller Creek Trail #505 | Avoidance per 1997 PMOA | Yes – eligibility and mitigation plan | Pending Consultation |
| FS D5-126 | All transmission line action alternatives | Libby Divide Trail #716 | Avoidance per 1997 PMOA | Yes – eligibiltiy and mitigation plan | Pending Consultation |

†Associated with the Libby Mining District.

### 3.7.4.11 Indirect Effects Common to All Alternatives

Indirect effects to cultural resources are possible from the increased access to the KNF that would result from the improvement and new construction of access roads. Effects would be more pronounced to visible historic properties such as mining or homesteading related cultural resources. Access would likely increase after closure of the mine and would result from recreational activities. Specific effects to cultural resources could include the illegal collection of artifacts and vandalism to standing structures or features.

## 3.7.5 Mitigation

All mine and transmission line alternatives would require additional cultural resource inventory to satisfy requirements of Section 106 under the NHPA and 22-3, MCA. The number of cultural resources that would require mitigation may increase pending the results of these additional inventory efforts. The appropriate type of mitigation is dependent on the nature of the cultural resource involved and is ultimately determined during consultation between MMC, the KNF, and the SHPO.

Mitigation could include data recovery (excavation) of prehistoric archaeological sites, a HABS for standing structures, or HAER for built resources such as mines, roads, and trails. For landscape-level resources such as the Libby Mining District, the USDI National Park Service's (NPS) Cultural Landscapes Program would be implemented. Mitigation also would include monitoring during ground disturbing activities when the subsurface spatial extent of the resource is unknown or because of the fragility of the resource and its proximity to the activity.

Any mitigation plan would be developed by MMC and approved by both the KNF and the SHPO under a memorandum of agreement (MOA), and would include consulting American Indian tribes if affected cultural resources were prehistoric or of recent cultural significance.

### 3.7.5.1 Mine Alternatives

#### *3.7.5.1.1 Alternative 2 – MMC's Proposed Mine*

Under Alternative 2, nine cultural resources would require mitigation. The largest of these is the Libby Mining District (24LN1323), which encompasses a large geographic area. Six other cultural resources contribute to the District. These include the Comet Placer (24LN320), an unnamed logging camp (24LN943), a dam (24LN980), the Libby Wagon Road (24LN1209), the Beager Cabin (24LN1677), and an unnamed cabin (24LN1678). Although two of the sites are not eligible for the NRHP (24LN943 and 24LN980) they may contribute to the overall significance of the District. The most appropriate mitigation would be to generate a Cultural Landscape Report under the USDI National Park Service's Cultural Landscapes Program. This report would document the history, significance, and treatment of the Libby Mining District as it currently exists within its bounded landscape. Individually, the remaining historic sites would require either HABS or HAER documentation (24LN320, 24LN1209, 24LN1677, and 24LN1678), including one site that has not been related to the District (24LN1680), but would probably be found to be contributing through further archival research. Two known but unrecorded sites require formal documentation and evaluation (D5-241 and D5-363). If either site is found to be eligible for the NRHP, mitigation would require both HABS and HAER documentation and may be included within the Libby Mining District and the Cultural Landscape Report.

#### *3.7.5.1.2 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative*

Under Alternative 3, two cultural resources would require mitigation. These sites are the Libby Mining District (24LN1323) and the Placer Mine (24LN1680). Mitigation efforts are described in mine Alternative 2.

#### *3.7.5.1.3 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative*

Under Alternative 4, four cultural resources would require mitigation efforts. Two of the sites, the Libby Mining District and the Placer Mine, have been discussed above under Alternative 3. The other two cultural resources that would require mitigation are the Comet Placer (24LN320) and the Libby Wagon Road (24LN1209). Depending on the type of physical remains associated with the Comet Placer, mitigation would entail either a HAER or HABS treatment. Mining engineering would require a HAER and standing structures would require a HABS. The Libby Wagon Road would require a HAER.

### 3.7.5.2 Transmission Line Alternatives

#### *3.7.5.2.1 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)*

Under Alternative B, five to six cultural resources would require mitigation. Portions of U.S. 2 (24LN1818) affected by the alternative have not been evaluated for the NRHP. If found to be eligible for the NRHP, mitigation for U.S. 2 would entail HAER documentation. Mitigation for the Libby Mining District (24LN1323) is discussed above under Alternative 2. Two of the sites, 24LN1584 and 24LN1585 can be avoided during pole placement and vegetation clearing and would not require mitigation. In the event that they could not be avoided, mitigation would include extensive photographic documentation. The two trails located within this alternative (D5-122 and D5-126 can also be avoided during pole placement. Visual effects to the trails could not be avoided under this alternative.

#### *3.7.5.2.2 Alternative C – Modified North Miller Creek Transmission Line Alternative*

Under Alternative C, six cultural resources would require mitigation efforts. The Libby Mining District is discussed above under mine Alternative 3. The five remaining cultural resources include four scarred trees (24LN1585), a single scarred tree (24LN722), which requires consultation to determine eligibility, and three linear resources: potential portions of U.S. 2 (24LN1818), the North Fork of Miller Creek Trail #505 (D5-122), and the Libby Divide Trail #716 (D5-126), both of which require avoidance under a 1997 PMOA. Although pole placement would avoid these linear resources, their associated setting would be compromised by development and would likely require a HAER in each instance. The single scarred tree and U.S. 2 would require consultation to determine eligibility.

#### *3.7.5.2.3 Alternative D – Miller Creek Transmission Line Alternative*

Effects to cultural resource sites 24LN208, 24LN722, 24LN1323, and 24LN1585 and proposed mitigation would be the same as described under Alternative B. Alternative D would cross the Teeter Peak Trail (24LN962), which has an unresolved eligibility status of not eligible. Review and consultation with the SHPO would be necessary to receive a consensus determination prior to project implementation.

Under Alternative D, all six cultural resources discussed above under Alternative C would require mitigation efforts. Potential mitigation efforts also would be the same as discussed under Alternative C.

#### *3.7.5.2.4 Alternative E – West Fisher Creek Transmission Line Alternative*

Under Alternative E, five cultural resources would require mitigation efforts. Sites 24LN1323 and 24LN722 and site leads D5-122 and D5-126 have been discussed above under Alternative C. The alternative also would affect a multi-component historic mining and prehistoric site (24LN720). If unavoidable, the mining portion of the site would require either HAER and/or HABS treatment and the prehistoric component would require data recovery (excavation).

### 3.7.5.3 Cumulative Effects

Past action, such as road building and timber harvest, may have affected cultural resources. Cultural resources affected by past actions after the passage of the NHPA in 1996 were mitigated in accordance with approved mitigation plans. The Miller-West Fisher Vegetation Management Project, which includes commercial timber harvest, trail construction, and other activities, could result in incremental cumulative effects to cultural resources within the APE for the Montanore Mine. Identified adverse effects to cultural resources from the Miller-West Fisher Vegetation Management Project would be addressed as part of a separate mitigation plan. No other reasonably foreseeable actions would have a cumulative effect with the Montanore Project.

### 3.7.5.4 Regulatory/Forest Plan Consistency

Following the identification of cultural resources, mitigation, and consultation, all alternatives would be in compliance with the KFP and all applicable federal regulations concerning cultural resources.

### 3.7.5.5 Irreversible and Irretrievable Commitments

Regardless of mine facility alternative or transmission line alternative, project implementation would require the irreversible commitment of portions of the Libby Mining District (24LN1323) and possibly a portion of 24LN1680. Five, and possibly six, NRHP eligible cultural resources would require irreversible commitments under Alternative 2: 24LN320, 24LN1209, 24LN1677, 24LN1678, 24LN2203, and possibly unrecorded site D5-241SL. Each of these sites would be destroyed following mitigation by the construction of mining related facilities. Their loss would be irreversible. Mitigation would serve to preserve these cultural resources in perpetuity through documentation. Pending consultation, an additional non-significant cultural resource would require irreversible commitments (24LN980). Aside from 24LN1323 and 24LN1680, no additional cultural resources would require an irreversible commitment. Alternative 4 would require irreversible commitments to sites 24LN320 and 24LN1209, in addition to sites 24LN1323 and 24LN1680.

### 3.7.5.6 Short-term Uses and Long-term Productivity

Because cultural resources are non-renewable, the short-term use of the area for project implementation has the potential for permanent impacts as discussed above under Alternative 2.

### 3.7.5.7 Unavoidable Adverse Environmental Effects

Unavoidable effects to cultural resources would be mitigated through the development of data recovery plans devised in consultation with the KNF, the SHPO and, if necessary, American Indian tribes.

# 3.8 Geology

Geology is the primary framework for most other resources discussed in the EIS. The geology controls the location of the mineral deposit to be mined, proposed mining techniques, environmental geochemistry, distribution of ground water in the subsurface, topography and, to some extent, the type of vegetation, and runoff of precipitation.

## 3.8.1 Analysis Area and Methods

The analysis and description of the geology of the proposed mine, tailings impoundment areas, and transmission line alternatives presented in this section are based on the 1992 Final EIS (USDA Forest Service *et al.* 1992) and subsequent descriptions provided by MMC. Because the geology typically does not change within human time scales, the previous analysis and descriptions in the 1992 Final EIS remain valid. No known studies would change the fundamental descriptions of the area. Elements of the geology that directly affect environmental geochemistry are emphasized within this description.

An environmental geochemical assessment of the waste and ore exposed in underground workings, tailings, and waste rock brought to the surface was conducted to evaluate the potential impact of discharge from mine facilities on downgradient surface and ground water quality. The specific geochemical issues of interest are acid generation and the potential release of metals and metalloids, regardless of acid production. The leaching of nitrate from blasting residues on ore, waste rock, and tailings is also a short-term concern. Factors of concern in predicting long-term environmental chemistry are therefore the occurrence and relative concentrations of metal and sulfide-bearing minerals (including non-acid generating sulfides), as well as their mode of occurrence (*i.e.*, in veins, on fractures or encapsulated within quartzite) and proposed management practices (*i.e.*, blasting, ore processing, and material placement) in terms of potential exposure to water and air.

A discussion of the geochemical methods used to predict trace element release and acid generation in the environment is provided at the start of section 3.8.3, *Environmental Consequences* below.

## 3.8.2 Affected Environment

### 3.8.2.1 Geologic Setting

#### *3.8.2.1.1 Physiography*

The Cabinet Mountains are bounded on the south by the Clark Fork River, on the east by Libby Creek, on the north by the Kootenai River, and on the west by the Purcell Trench in Idaho. The Bull River/Lake Creek valley separates the mountain range into east and west segments. The analysis area is in the southeast portion of the Cabinet Mountains and the portions of the Fisher River watershed between the Cabinet Mountains and Salish Mountains east of Libby. The Cabinet Mountains are a northwest-trending mountain range of rugged relief. The maximum relief in the analysis area is about 5,000 feet. The highest elevation in the vicinity is Elephant Peak at an elevation of 7,938 feet. The lowest elevations are 3,200 feet along Libby Creek and 2,900 feet along the Fisher River. The proposed plant site in Ramsey Creek is at an elevation of 4,400 feet; the elevation of the proposed tailings impoundment in Little Cherry Creek is at about 3,500 feet; and the elevation of the proposed Sedlak Park Substation is at 3,000 feet.

Area topography (Figure 42) is a function of the underlying rock types, structure (faults and folds), and geologic history. Slopes are generally steep (more than 30 percent) except along streams and rivers. Rocks in the area are relatively strong and not easily erodible. Most of them weather into small, thinly laminated fragments that form a colluvial (transported by gravity) mantle overlying bedrock. The talus slopes and hogback ridges are usually formed by the more weather resistant quartzite and limestone rocks.

Large faults bound the Cabinet Mountains on the east, south, and west. These faults are at least partly responsible for the formation of the valleys surrounding the Cabinet Mountains. The Clark Fork River, Libby Creek, Bull River-Lake Creek, and the West Fork Rock Creek valleys are all located along faults. A number of smaller streams in the analysis area also may be located along fault and fracture structures. The major land-forming features were created by the Rocky Mountain uplift and subsequent faulting. Topography in the analysis area has been influenced by Pleistocene-age glaciation (2 million to 10,000 years ago). In the northern part of the analysis area, Pleistocene alpine glaciers carved the landscape into a series of glacial features characterized by nearly vertical cliffs, ledges, steep colluvial slopes, and talus fields. The high peaks of the area (St. Paul, Rock, and Elephant peaks) are glacial horns formed by the headward erosion of the glaciers. Small- to moderate-sized lakes (tarns), such as Copper and Cliff lakes, have formed in the glacial cirque basins.

Pleistocene-age glaciation sculpted the mountain peaks, scoured some lower elevation areas, and created a veneer of glacial deposits. Glacial lakebed deposits (silt and clay accumulations of 100 or more feet thick) were deposited in low-elevation drainages. Melt-waters from glaciers in the upper part of the analysis area carried large amounts of excavated rock debris into creeks draining the higher topographic areas, filling portions of the valley bottom. Relict terraces of the former valley bottom are exposed as higher-level benches along lower portions of many of the creeks. In many areas, the creek has since down-cut into the valley fill.

Higher elevation creeks generally flow through relatively narrow canyons and then spill into wider valleys at the periphery of the wilderness area. The wider valleys have flat to rolling bottoms, with lakebed and stream deposits capping and surrounding shallow to exposed bedrock.

#### *3.8.2.1.2 Regional Geology*

The Cabinet Mountains and surrounding areas are composed of a thick series of metasedimentary rocks referred to as the Belt Supergroup. These Belt rocks were deposited in a subsiding basin about 1,450 to 850 million years ago (Harrison 1972). Originally deposited as a series of muds, silts, and sands, the deposits were metamorphosed to argillites, siltites, and quartzites, respectively.

The Belt Supergroup can be divided into four major conformable groups. In ascending order, these are the Lower Belt, Ravalli Group, Middle Belt carbonate (Table 73), and the Missoula Group (not shown in Table 73). Regionally, the Lower Belt is represented by the Prichard Formation. The Prichard Formation consists mostly of argillites, with some interbedded siltite and quartzite units. It is the lowest formation within the Belt Supergroup in this area and is mapped as the thickest at 25,000 feet.

**Table 73. Stratigraphy of Montanore Analysis Area.**

| Supergroup | Group | Formation | Member |
|---|---|---|---|
| Belt | Middle Belt Carbonate | Wallace | Upper<br>Middle<br>Lower |
| | Ravalli | Empire / St.Regis | |
| | | Revett | Upper<br>Middle<br>Lower (ore zone)<br>See detail below |
| | | Burke | — |
| | Lower Belt | Prichard | Transition<br>Upper<br>Lower |

| Formation | Member | Bed | Deposit |
|---|---|---|---|
| Revett | Upper | Upper quartzite<br>Upper siltite<br>Middle quartzite | Troy |
| | | Lower siltite | |
| | | Lower quartzite | Troy |
| | Middle | | |
| | Lower | A | Rock Creek-Montanore |
| | | B | |
| | | C | |
| | | D | |
| | | E | |
| | | F | |
| | | G | Troy |
| | | H | |
| | | I | |

Source: Boleneus *et al.* 2005.

The Ravalli Group in this part of the Belt Supergroup basin consists of, from oldest to youngest, the Burke, Revett, and St. Regis Formations. The Burke Formation is composed primarily of siltites and its contact with the underlying Prichard Formation is gradational. The Revett Formation is a north- and east-thinning wedge of quartzite, siltite, and argillite. In the Cabinet Mountains area, the Revett is informally divided into lower, middle, and upper members. The lower and upper members are dominated by quartzites with interbedded siltite and argillite; the middle member is mostly siltite with interbedded argillite and quartzite. Facies changes, from coarse to finer sediments, are well documented. The St. Regis Formation is dominantly silty argillite and argillitic siltite.

The Middle Belt carbonate is separated into a western and eastern facies. The western facies Wallace Formation contains a conspicuous clastic component (but still contains a considerable proportion of carbonate material) and was deposited from a southern source terrain; the eastern

facies Helena Formation is largely a carbonate bank deposited along the Canadian Shield (USDA Forest Service and DEQ 2001). The two Formations interfinger or overlap along a broad zone that extends from Missoula northwest toward the Canadian border just east of Libby, Montana (Harrison 1972).

Regionally, Paleozoic sediments are represented by an occasional north-northwest trending exposure of shale, sandy shale, dolomite, magnesium-rich limestone, and sandstone, some of which are fossiliferous. The exposures are along U.S. 2, south of Libby, MT, along Montana 200 near the Montana-Idaho border, and in several other localities. These sediments are mapped as narrow fault-bound blocks that were caught between eastwardly thrusted Belt strata (Johns 1970). Rocks in the analysis area are unlikely to be a source of significant paleontological resources.

The mine area bedrock has been extensively folded and faulted along generally north to northwest trends. Most of this structural activity was related to complex plate interactions that occurred between 24 and 200 million years ago, and resulted in the rocks being thrust eastward along shallow dipping faults for up to 100 miles (Harrison *et al.* 1983). These faults were superimposed on the existing compressional structures. One of several prominent structures is the Hope Fault, a west to northwest-trending right lateral strike slip structure with major displacement within the Clark Fork drainage.

Quaternary age deposits are reflected in Pleistocene glacial erosion and deposition of stratified and unstratified sediments. Large areas are covered by glaciofluvial and glaciolacustrine sediments to depths up to several hundred feet. Near Libby, Montana, bluffs of glaciolacustrine silts stand up to 200 feet above the recent floodplain. Glaciolacustrine silts and clays prone to sloughing from road cuts are found at elevations between 2,900 and 4,000 feet in the two tailings impoundment areas, along the Fisher River, and along lower Miller and West Fisher creeks. During recent times, this and older materials have been eroded and reworked by stream activity.

There appear to have been three mineralizing events in the Belt rocks of this area. Most recently, Cretaceous to early Tertiary age granodiorite and quartz monzonite plutons intruded the highly folded and faulted Belt rocks in the central and northern portions of the Cabinet Mountains. This produced the mineralization of the prospects found along the eastern and southern flanks of the Cabinet Mountains. An older event involved the Precambrian age intrusions of igneous rock high in iron and magnesium that intruded the Wallace, Burke and Prichard Formations. The Purcell Lava is an example of such an event, which created the vein-hosted deposits found in the Ten Lakes area northeast of the Cabinet Mountains. The oldest mineralizing event is the Precambrian age migration of solutions through selected Formations within the Belt Supergroup, especially the Revett Formation, prior to or during lithification (Clark 1971; Hayes 1983; Lange and Sherry 1983).

The western Montana copper belt, first named by Harrison in 1972, hosts several large strata-bound Revett-style copper-silver deposits in permeable quartzite beds of the Revett Formation (Boleneus *et al.* 2005). Several Revett-style deposits, which occur in the upper and lower members of the Revett Formation, have been intensively studied by numerous investigators (Clark 1971; Harrison 1972; Hayes 1983; Lange and Sherry 1983; Bennett 1984; Hayes and Einaudi 1986; Hayes and Einaudi 1990). The world-class Rock Creek-Montanore deposit, currently under permitting review as two separate mining operations, and the Troy Mine (Spar Lake deposit) are each hosted in the Revett Formation. The Rock Creek portion of the deposit is separated from the Montanore (Rock Lake) portion by the Rock Lake fault. This document

follows the USGS nomenclature, which distinguishes the Rock Creek-Montanore deposit from the Troy deposit, as described by Boleneus et. al. (2005). In cases where data have been collected solely from the Rock Creek or the Montanore portion of the Rock Creek-Montanore deposit, the term sub-deposit has been used.

Ore-grade stratabound copper-silver deposits in the Revett Formation are concentrated along a pre-mineralization pyrite-hematite interface, in relatively coarse-grained quartzite that acted as a paleoaquifer for ore-forming fluids. These deposits are characterized by pronounced zonation based on alteration-mineral assemblages, with ore typically occurring between the chalcopyrite-ankerite and pyrite-calcite zones. Mineralization is consistent throughout the Belt basin, with minor variations between defined deposits resulting from subtle variations in the stratigraphy of the interbedded quartzite, siltite, and argillites that comprise the Revett Formation. Boleneus *et al.* (2005) provide a comprehensive summary of this district and style of mineralization.

### *3.8.2.1.3 Geology of Analysis Area*

#### Mine Area

Table 73 presents general stratigraphy for the analysis area, and Figure 57 is a bedrock geology map for the portion of the CMW area that overlies the sub-deposit at Montanore. The Prichard Formation is the oldest unit at Montanore and consists primarily of quartzite, with argillite, siltite, and mudstone. The Burke, St. Regis, and Empire Formations of the Ravalli Group are predominantly siltite, argillite, and quartzite. The Revett Formation, also of the Ravalli Group, is subdivided into three members based on the amount of quartzite, silty quartzite, and siltite. The Rock Creek-Montanore, stratabound copper and silver deposit is found in the A-D quartzite beds in the uppermost portion of the lower member of the Revett Formation, which consists primarily of quartzite and layers of siltite and silty quartzite. The Wallace Formation is the younger Middle Belt Carbonate group of rocks in the analysis area.

The Cabinet Mountain region was subject to folding and faulting during mountain building. Structural anticlines and synclines are present throughout the Cabinet Mountain region. The folds range from tight to open and symmetrical to asymmetrical (USDA Forest Service and DEQ 2001). Structural features trend to the northwest or north, including primary faults, which tend to parallel folds. The region is part of the Libby Thrust Belt (USDA Forest Service and DEQ 2001) and principal faults in the Montanore analysis area are the Rock Lake fault and Libby Lake fault. The Rock Lake Fault separates the Rock Creek-Montanore deposit into two portions that are proposed to be operated as the Rock Creek and Montanore Projects, respectively.

Mine Development Associates (2003) report that Montanore sub-deposit mineralization occurs in the lower limb of a north-northwest plunging, breached overturned syncline (Figure 58 and Figure 59). The syncline axis extends to the east at about 45 degrees and the syncline opens to the northwest (Figure 58 and Figure 59). This creates a progressively wider flat-lying lower limb. The lower limb is not folded but dips about 15 degrees to the northwest. Mineralization in the Montanore sub-deposit is observable in the discovery outcrop of Revett Formation located on the north shore of Rock Lake.

The west-southwest boundary of mineralization is the northwest trending, near the vertical Rock Lake Fault that produced at least 2,500 feet of vertical displacement (Figure 58). The fault trends N35° W for about 12 miles with the down-dropped side to the northeast. The USGS (1981)

reports three periods of movement can be distinguished for the Rock Lake Fault. The syncline is bound on the east by several splays of the Libby Lake Fault (Figure 58).

**Montanore Sub-deposit**

The Rock Creek-Montanore deposit occurs in the Revett Formation, which is subdivided into the upper, middle, and lower Revett, based upon the amount of quartzite, silty-quartzite, and siltite. The majority of the silver and copper mineralization occurs in the A-D quartzite beds within the upper portion of the lower Revett. Within the Montanore sub-deposit, this mineralized zone lies on the lower limb of the overturned syncline, and is truncated on the west by the Rock Lake Fault (Figure 58), which separates the Montanore sub-deposit from the Rock Creek portion of the overall deposit. The mineralization is predominantly copper and copper-iron sulfides, including bornite, chalcocite, and chalcopyrite, deposited as intergranular cements in permeable beds and as replacements of clasts and earlier cements. Silver occurs as native silver, and in solid solution in copper minerals. Localized concentrations of ore minerals reflect faults and increased permeability in the quartzite beds (Boleneus *et al.* 2001). Lead sulfides (galena) and iron sulfides (pyrite and pyrrhotite) occur within haloes around the ore zone, but do not occur in any significant quantities within the ore.

The silver and copper ore zones are separated by a low-grade barren zone of disseminated and vein-hosted galena. The barren zone varies in thickness from more than 200 feet toward the west to 18 feet in the eastern portions of the mine area. The barren zone may be absent to the northeast.

Mineral zones, defined by the appearance, disappearance, and abundance of authigenic sulfide and gangue minerals, are developed that crosscut the stratigraphic units in the Revett Formation. This zonation is consistent with similar alteration mineralogy and crosscutting relationships observed in stratabound copper and silver deposits worldwide, and define the ore zone as well as key zones of environmental significance within the Revett Formation. The distribution and extent of mineral zonation in the Revett Formation is controlled by the migration paths of mineralizing fluids, which change in response to differences in porosity between the quartzite, siltite, and argillites that are variably interbedded across the basin. These zones are important, not only for the identification of ore, but also for identification of zones enriched in sulfides that are potentially acid generating when oxidized, such as pyrite and chalcopyrite, and those that are acid consuming, such as bornite, chalcocite, and digenite.

Mineralization within the Revett Formation is consistent throughout the depositional basin. As discussed by Maxim Technologies (2003) and Enviromin (2007), the Rock Creek-Montanore deposit was deposited within the Proterozoic Revett basin under the same conditions as the Troy deposit, which is located in a mineralogically comparable setting, but in different stratigraphic zones within the Revett Formation. The Troy deposit has been mined over the past 29 years, and a substantial amount of geological, mineralogical, and water quality data are available for this deposit that provide full-scale estimates of environmental geochemistry behavior. Analyses of drill samples from the Rock Creek-Montanore deposit have generated laboratory-based sets of mineralogical and geochemical information for comparison with the larger set of empirical data available from the Troy Mine. Comparison of data from the Rock Creek-Montanore and Troy deposits provides useful information regarding the potential geochemical effects of development of the Montanore sub-deposit.

Mineral zonation was studied in the Troy deposit, where alteration zones were described in detail based on the dominant sulfide and distinct non-sulfide minerals present, along with color. These

alteration styles include the pyrite-calcite, galena-calcite, chalcopyrite-calcite, bornite-calcite, chalcocite-chlorite, chaldopyrite-ankerite, hematite-calcite, and albite zones (Hayes and Einaudi 1986). The pyrite-calcite and chalcopyrite-ankerite boundary represents the boundary between reduced and oxidized rocks, along which ore-grade minerals, bornite-calcite and chalcocite-chlorite zones were deposited. The chalcopyrite-calcite and galena-calcite zones lie between the ore and the pyrite-calcite zone. In the Montanore sub-deposit, the barren "lead" zone associated with the ore hosts galena as a primary mineral. The location and relative magnitude of the mineral zones is generally controlled by grain-size characteristics of individual stratigraphic units, although the alteration crosscuts stratigraphic units. A broad belt of pyrite-calcite occurs in the A-D beds of the lower Revett at both Troy and Rock Creek-Montanore deposits, with some variation in zone thickness related to local changes in sediment porosity (argillite vs. quartzite), as well as displacement by more recent structural activity. Because these zones host sulfide and carbonate minerals that could affect acid generation and neutralization potential, it is important to understand their occurrence within the Montanore sub-deposit.

In the Montanore sub-deposit, rock exposed in the stopes and adits would include both ore and the barren-lead zone of galena-calcite halo mineralization within the Revett Formation. In the adits, lesser amounts of chalcopyrite-calcite and pyrite-calcite alteration haloes also would be exposed within the lower Revett Formation, along with the Prichard and Burke Formations in the Ramsey Adits. It is possible that a small amount of rock from Wallace Formation would be intercepted in the Ramsey Adits as well. Six mineralogically and lithologically distinct rock units would be exposed underground or mined as waste rock at the proposed Montanore Mine.

MMC collected 11 representative samples from five drill holes and analyzed them for asbestos by Polarizing Light Microscopy. No asbestos fibers were detected in any sample (Jasper Geographics 2005).

#### Tailings Impoundments and LAD Areas Geology

Surficial geology at the proposed Little Cherry Creek Tailings Impoundment Site is dominated by Quaternary glacial deposits (Figure 60). More detailed geology and cross sections of the tailings impoundment are provided in Figure 61. As much as 300 feet of unconsolidated deposits of silt, sand, and gravel overlie the Wallace Formation in both tailings impoundment areas. Fine-grained glacial lake (glaciolacustrine) materials dominate the center and eastern portion of tailings impoundment sites and interfinger with intermixed silt, sand, and gravel glaciofluvial materials present on the western portion of the site. Based on borehole data, a buried glaciofluvial channel, more than 370 feet thick, trends west to east through the center of the Little Cherry Creek Tailings Impoundment Site (Figure 61) (Klohn Crippen 2005).

Bedrock exposures are limited in the Little Cherry Creek Tailings Impoundment Site, and have been observed mainly on the steep, north-facing slopes exposed in Little Cherry Creek downstream of the tailings dam and hills to the north and south of the tailings impoundment above an elevation of 3,700 feet. Most bedrock fractures appear to be related to sedimentary bedding planes, but drill samples also show occasional near-vertical joints and irregular fractures. The approximate thickness of surficial sediments at the Little Cherry Creek Tailings Impoundment Site is (Klohn Crippen 2005):

- North Saddle Dam = 135 feet
- South Saddle Dam = 10 to 45 feet

- Diversion Dam = 20 to 50 feet
- Main Dam = 20 to over 300 feet

The surficial geology of the Poorman Tailings Impoundment Site is similar to that of the Little Cherry Creek Tailings Impoundment Site (Figure 60). Based on a resistivity survey, the thickness of the unconsolidated deposits range from near zero in the upper portions of the basin to more than 300 feet thick in the lowest portion of the basin (Chen-Northern 1989). The resistivity survey and limited drilling did not identify any buried channels, as occurs in the Little Cherry Creek site.

The two LAD Areas are located on a low, flat ridge between lower Ramsey Creek and Poorman Creek. Geology at the two LAD Areas is mapped as Quaternary glacial deposits, similar to those found in the tailings impoundment sites (Figure 60). These glacial deposits form an eastward-thickening wedge up to 200 feet thick, beginning at an elevation of about 4,000 feet on the flank of the Cabinet Mountains (USDA Forest Service *et al.* 1992). Ravalli Group bedrock is present west of the LAD Areas and rocks of the Wallace Formation are to the east.

### 3.8.2.2 Mining History

Mineral activity in this area dates back to the 1860s with the discovery of placer gold along Libby Creek on the east side of the Cabinet Mountains (Johns 1970). Subsequent exploration in the 1880s and 1890s led to the discovery of numerous small hard rock mineral deposits. Many of these hard rock mineral deposits were discovered along the east side of the Cabinet Mountains. Production from these veined deposits and the area's placer deposits was sporadic and short lived. None of these mineral deposits is currently in production.

In the late 1890s and then in the 1920s and 1930s, several small prospects were worked west of the Cabinet Mountains divide in and around the analysis area. The Freeman prospect occurs just above Copper Lake. It consists of a few short adits and workings in a northwest-striking copper and silver quartz vein in the Copper Lake Fault Zone. Located about 1 mile south of the proposed Montanore Mine, the Heidelberg Mine consists of several adits just south of Rock Lake. Most of these old workings were driven on gold-bearing quartz veins in what is probably the southern end of the Snowshoe Fault near its junction with the Rock Lake Fault. Numerous other diggings (generally shallow) occur along the northwest-trending faults that cut the area. All of these prospects were short lived and very little, if any, production was created (Gibson 1948).

In the 1960s through the 1980s, three major deposits and numerous smaller deposits containing stratabound copper and silver mineralization were discovered. These discoveries were confined to the Revett Formation and situated within a narrow belt extending from the Coeur d'Alene Mining District north to about the Kootenai River. ASARCO brought the 64-million-ton Spar Lake deposit into production in late 1981, producing about 4.2 million ounces of silver and 18,000 tons of copper per year from the Troy Mine. The 145-million-ton Rock Creek sub-deposit in the CMW is the second deposit. The permitted Rock Creek Project proposes to mine this sub-deposit. The Montanore sub-deposit, proposed for mining by the Montanore Project, is the third deposit.

## 3.8.3 Environmental Consequences

### 3.8.3.1 Mine Drainage and Trace Element Release

#### *3.8.3.1.1 Alternative 1 – No Mine*

If the proposed Montanore Project were not constructed, mine drainage issues would be limited to the negligible influence of exposed Prichard and Burke Formations in the Libby Adit, seepage from the reclaimed waste rock pile located near to the adit, and ground water discharge from the adit. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

#### *3.8.3.1.2 Alternative 2 – MMC's Proposed Mine*

Following a review of the mechanisms of acid production and trace element release, and a discussion of the use of the Troy deposit as a geochemical analog for the Rock Creek-Montanore deposit, the environmental geochemistry of material that would be mined or produced by the Montanore Project is described using data from the Rock Creek and Montanore sub-deposits, as well as the Troy deposit. These data include static whole rock metal concentrations, acid generation potential, and metal mobility test data, as well as kinetic test and monitoring data, which are summarized by project (Montanore, Rock Creek and Troy mines) for ore, tailings, and waste rock. Release of nitrate associated with blasting residues from mining is also discussed.

**Acid Rock Drainage**

Acid Rock Drainage (commonly called ARD) results from oxidation of iron-sulfide minerals during weathering. Iron sulfide, particularly pyrite ($FeS_2$), chalcopyrite ($CuFeS_2$), and pyrrhotite ($Fe_{1-x}S$) are the most common acid-producing sulfide minerals and much research is available on their oxidation (Price and Errington 1998). Impurities in a sulfide crystal structure, or oxidative differences between iron sulfides and copper, zinc or lead sulfides also will determine oxidation rates. Other types of sulfides, such as bornite ($Cu_5FeS_4$), chalcocite ($Cu_2S$), digenite ($Cu_9S_5$), sphalerite ($ZnS$) and galena ($PbS$) actually inhibit or decrease acidity because they either do not produce acid or consume it as a result of oxidation (Maxim Technologies 2003; Enviromin 2007).

Sulfide minerals are chemically unstable in oxidizing air- and water-rich surface environments, where they are far from the equilibrium conditions of the reduced subsurface environment in which they were formed. Acid generation results from the oxidation of iron sulfide minerals to ferrous iron (Fe (II) or $Fe^{+2}$) and sulfuric acid ($H_2SO_4$). If not neutralized, acidity will cause a drop in pH and enhance metal solubility. At low pH (below pH 4), ferric iron (Fe III or $Fe^{+3}$) produced by acid-loving iron oxidizing bacteria speeds up sulfide minerals oxidation, so that the amount of acid produced increases as pH declines. If acidity generated through these processes at the mineral surface is neutralized, by buffering minerals such as calcium carbonate, or water is not available to transport oxidation products away from the mineral surface, ARD is unlikely to develop. Where water is available, and there is insufficient neutralizing capacity (buffering) of the solution, ARD can occur. In either case, metals released into solution can remain soluble depending upon their individual sensitivity to pH and oxidation.

The potential for ARD formation depends on the balance between the rates of acid-generating and acid-consuming reactions. ARD potential can be estimated using a static acid base accounting test, which calculates the difference in total concentration of acid neutralizing and acid generating minerals, *i.e.*, acid-base account (acid base potential) = neutralization potential - acid potential (ABA or ABP = NP – AP), in units of tons/thousand tons as calcium carbonate (T/kT $CaCO_3$). The calculated ABA is then compared to standards, wherein values less than -20 are considered acid producing, greater than 20 are considered non-acid generating, and values between -20 and 20 are considered to have uncertain acid generation potential. An alternative approach, comparing the ratio of NP/AP, uses criteria of less than 1 as acid producing, greater than 3 as non-acid generating, and between 1 and 3 as having an uncertain potential for acid production.

The net generation of acid from a rock or waste rock facility is related more to the reactivity of sulfide and neutralizing minerals than the total concentrations, so that static tests may over-predict potential for acid generation. The pH decrease associated with ARD occurs if acidity is produced at a faster rate than alkalinity or when neutralizing minerals are consumed by excess acid. The development of acid drainage is time-dependent and, at some sites, may form after many years of slow depletion in available alkalinity or slowly increasing sulfide oxidation (Price and Errington 1998). Kinetic test methods are used to evaluate rates of reaction when static methods suggest uncertain potential for ARD. Monitoring of long-term environmental chemistry in analogous geochemical settings also provides excellent predictive information. Drainage from acid-producing rocks typically contains elevated concentrations of metals, which are generally more soluble under acid conditions and can adversely affect water quality and aquatic life.

Microbial processes can speed up sulfide oxidation and significantly increase the acid production. The type of bacteria participating in sulfide oxidation depends on pH, as does the actual speed of oxidation by the organism. At near neutral pH, acid generation occurs primarily from chemical oxidation of sulfide, with biological oxidation playing only a minor role in sulfur oxidation. If the neutralizing potential of a rock material is exhausted and pH values drop below 4, iron oxidizing bacteria will rapidly oxidize ferrous iron (Fe II) of pyrite directly to ferric iron (Fe III), which can oxidize the sulfide minerals. *Acidiothiobacillus ferrooxidans* is a common bacterium that makes energy by oxidizing iron sulfide minerals in low pH environments (below pH 4) (Schippers *et al.* 2000).

Mineralogic texture and chemistry must be evaluated when testing for acid generation and metal release potential. For example, decreased contact with oxygen and water due to cementation limits oxidation. Temperature, pH, and availability of water and oxygen also affect rock-water interactions.

### Trace Element Release

The release of trace elements from mined rock is a concern regardless of the potential for acid generation. Although acidic drainage presents the greatest potential for metal release, elevated concentrations of some metals can also occur in seepage from "non-acid generating" or near-neutral mine wastes. This happens when metals that are released during sulfide oxidation remain soluble after any related acidity is neutralized. This is particularly true for metals and metalloids, such as zinc, manganese, and arsenic, which have enhanced solubility under neutral or alkaline conditions. Elevated concentrations of metals can also result from dissolution of non-acidic metal-bearing minerals such as salts.

### Nitrates

Elevated concentrations of the nutrients nitrate and ammonia can also occur in mine drainage, as a result of explosive use in blasting during mining.

### Troy as a Geochemical Analog for the Montanore Sub-Deposit

The Troy Mine, developed within the upper quartzites of the Revett Formation, is an excellent depositional and mineralogical analog for the zone of quartzite to be mined within the upper-most part of the lower Revett Formation at both of the Montanore and Rock Creek sub-deposits. Geological analogs are valuable techniques for predicting acid generation potential and/or water quality from a proposed mine site (Price and Errington 1998). This type of comparison is based on the assumption that mineralization formed under comparable conditions within the same geological formation, and having undergone similar geological alteration and deformation, will have similar mineralogy and texture and, thus, similar potential for oxidation and leaching under comparable weathering conditions. Further, the ability to study environmental geochemical processes in the same rocks at full scale and under real-time weathering conditions provides a valuable basis for evaluation of laboratory test results.

Hayes (1983) and Hayes and Einaudi (1986) conducted detailed mineral paragenesis studies of the Revett-style mineralization, and concluded that the geochemistry and risk for ARD from the Troy and Rock Creek-Montanore deposits are the same, as defined by the observed mineral zonation (Hayes 1997). Hayes found that the ore zones of both deposits contain no detectable amounts of pyrite. There are two ore zones identified for both the Rock Creek Project and the Troy Mine. One ore zone is primarily bornite, digenite, calcite, and native silver and the other ore zone contains chalcocite and chlorite. In another study comparing mineralization for the two deposits, Maxim Technologies (2003) showed that the three Revett-style copper and silver deposits in northwest Montana cannot be statistically distinguished from one another based on copper or silver assay values.

Hayes reported that pyrite characteristically occurs in disseminated and isolated clots within the quartzite, where it is isolated from weathering, rather than on fracture surfaces. He also found that the post-sulfide cementation of quartz overgrowths on all grains resulted in an impermeable rock with little porosity. These results were confirmed in independent studies of Rock Creek ore in a validation study conducted for the Forest Service in 2003 (Maxim Technologies 2003; Enviromin 2007).

Four alteration halos surrounding the ore zones in both the Troy and Rock Creek-Montanore deposits would be mined as waste rock to varying degrees depending upon the geometry of underground workings at each mine. The amount of pyrite ($FeS_2$) also varies within these four halos, so potential for acid generation and trace element release may vary more between the three projects for waste rock than it would for ore. According to Hayes' data, of the two halos that immediately surround the ore zones, the chalcopyrite-ankerite halo contains "local trace" amounts of pyrite, while the chalcopyrite-calcite halo contains no pyrite. The galena-calcite halo contains a "trace" amount (less than 0.1 percent) of pyrite, while in the pyrite-calcite halo "…pyrite constitutes only an average of about 0.2 volume-percent of the rock whereas the calcite constitutes an average of around 4%." Pyrrhotite ($Fe_{1-x}S$) was logged infrequently in trace amounts in the pyrite-calcite halo only. These mineralogy data suggest that waste rock mined from the alteration haloes has some potential for acid generation and trace element release that should be fully evaluated for the proposed Montanore Project.

### Geochemistry of Revett-style Copper and Silver Deposits in Northwestern Montana

Table 74 summarizes the thousands of surface and drill samples that were collected, described in detail for mineralogy including sulfide content, and assayed for copper and silver, for each of the three Revett-style copper and silver projects, Rock Creek, Montanore, and Troy. This table also summarizes the average acid base potential and whole rock metal contents for ore, tailings, and waste rock. The number and type of metal mobility and kinetic humidity cell tests is also shown. These data have been collected over time by various investigators and reflect differences in style and methods of sampling for each of the three Revett-style copper and silver deposits. For example, considerably more waste rock data were collected for the Montanore sub-deposit, while tailings characterization is more comprehensive for the Rock Creek sub-deposit. The most detailed studies of Revett-style copper and silver ore mineralization were conducted underground at the Troy Mine, where exposures could be studied in mine workings. Together, the mineralogy and chemistry of ore, tailings, and waste rock, data from the Rock Creek-Montanore and Troy deposits provide a comprehensive baseline assessment of the rock to be mined at any individual mine site. For these reasons, the following discussion focuses on data collected specifically for the proposed Montanore Project, but includes information for the Rock Creek sub-deposit and Troy mines as well.

MMC has prepared comprehensive summary tables of the available static geochemistry data characterizing rock for the proposed Montanore and Rock Creek mines by test method in tables appended to their waste rock management plan (Geomatrix 2007b). Average values for acid base potential, whole rock chemistry, and assays based on these data, along with data reported by Maxim Technologies (2003) and DEQ (1996), Golder (1996), USDA Forest Service *et al.* (1992), USDA Forest Service and DEQ 2001), and Schafer (1992, 1997) are presented in Table 74. This table provides a brief summary of data presented and discussed in a geochemistry technical summary report (Enviromin 2007).

#### *Ore*

As discussed above, ore in the Rock Creek-Montanore deposit contains the copper sulfide minerals bornite, chalcocite, and digenite. These minerals are not acid generating and based on delineation criteria, no pyrite occurs in the ore zone. Minor chalcopyrite and galena occur as interbeds and in halos with calcite at the periphery of the deposit. Fewer quantitative mineralogy analyses are available for the Montanore sub-deposit than have been collected for the Rock Creek and Troy deposits, but extensive hand specimen descriptions (for thousands of described intervals, as shown in Table 74) are available in drill logs. Detailed mineralogy studies indicate that 90 percent of the sulfide is encapsulated in the silica matrix of the quartzite in the Revett Formation at the Troy Mine (Enviromin 2007). Formation of quartz overgrowths were documented for both the Troy (Hayes 1983) and Rock Creek deposits (Maxim Technologies 2003), and based on the comparable depositional and post-depositional history, can be expected to have resulted in silica encapsulation of sulfide minerals within the Montanore sub-deposit as well. A summary of the average sulfur and acid generation potential data characterizing ore for the Rock Creek-Montanore and Troy deposits is presented in Table 74. Ranges reported below for these averages are based on discussion and data presented by Enviromin 2007.

**Table 74. Geochemical Data for Northwestern Montana Revett-Style Copper and Silver Deposits.**

| | Montanore | | | | | | Rock Creek | | | | | | Troy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ore | | Tailing | | Waste | | Ore | | Tailing | | Waste | | Ore | | Tailing+ | | Waste | |
| | n | mean | n | mean | n | mean | n | mean | n | mean | n | mean | n | mean | n | mean | n | mean |
| **Static Acid Generation Potential** | $ | | | | $ | | **,$$ | | $$,** | | **,$$,+ | | + | | $,# | | | |
| ABA, T/1000T CaCO3 (NP:AP ratio) | 35 | -4 (0.8) | 1* | 8 (25.8) | 155 | | 36 | 5.1 (2.3) | 1 | 10 (11) | 28 | 3.6 (5.8) | 17 | 7.6 (7) | 2 | 2.8 (2.1) | nd | |
| Prichard Formation | | | | | 70 | 7 (3.7) | | | | | nd | bd | | | | | | |
| Burke Formation | | | | | 19 | 15 (12) | | | | | nd | nd | | | | | | |
| Lower Revett Formation | | | | | 66 | 4.2 (3.5) | | | | | 14 | 3.6 (1.9) | | | | | | |
| Total Sulfur, weight % | 35 | 0.29 | 1 | 0.01 | | | 34 | 0.25 | 13 | 0.012 | 14 | 0.12 | 17 | 0.2 | 2 | 0.08 | | |
| Total Sulfur, weight % adjusted | nd | | | | | | 34 | 0.1 | | | 10 | 0.1 | 17 | 0.05 | nd | | | |
| **Whole Rock/Metals** | | | | | | | **,+ | | ** | | **,+ | | + | | # | | | |
| Copper, ppm | nd | | nd | | nd | | 35 | 6382 | 13 | 391 | 14 | 31 | 16 | 6456 | 2 | 818 | nd | |
| Silver, ppm | nd | | nd | | nd | | 35 | 31 | 13 | 2.5 | 14 | <2 | 16 | 26 | 2 | 7 | nd | |
| **Assay Claim Validation** | ** | | | | | | ** | | | | | | ** | | | | | |
| Copper, ppm | 213 | 5400 | | | | | 347 | 6700 | | | | | 269 | 7100 | | | | |
| Silver, ppm | 213 | 45.7 | | | | | 347 | 52.2 | | | | | 269 | 44.5 | | | | |
| Sulfur, weight %, calculated from Cu | 213 | 0.14 | | | | | 347 | 0.17 | | | | | 282 | 0.18 | | | | |
| **Mineralogical Analysis** | | ** | | | ** | | ** | | | | ** | | ** | | | | ** | |
| Quantitative/analytical | | | | | | | 10 | nr | | | 2 | nr | >100 | nr | | | >100 | nr |
| Feet drilled | 1,500 | nr | | | 2,375 | nr | 3000 | nr | | | 4000 | nr | 11429 | nr | | | 45000 | nr |
| Mineralogy Descriptions | 1,000 | nr | | | 2,000 | nr | 1500 | nr | | | 3000 | nr | 4798 | nr | | | 22500 | nr |
| Assays | 1,500 | nr | | | 2,375 | nr | 7255 | nr | | | nd | nr | 3799 | nr | | | nd | nr |
| **Metal Mobility Tests** | $ | | | | | | $,** | | | | $,** | | | | # | | | |
| EPA TOX (EPA Method 1310) | | | | | | | | | | | 1 | | | | | | | |
| TCLP (EPA Method 1311) | 1 | nr | nd | | nd | | 13 | nr | nd | | 14 | | nd | | 1 | nr | nd | |
| SPLP (EPA Method 1312) | | | | | | | 12 | nr | | | 14 | | | | 1 | nr | | |
| **Humidity Cell Tests**, final pH, s.u. | 1 | 6.98 | 1 | 8.9 | 4 | 7.15 | 1 | neutral | | | | | nd | | | | nd | |

*After Enviromin, 2007, Tables 3-1, 3-2, 3-3, based on ^Geomatrix, 2007b; **Maxim, 2003; +MDEQ,1996; #Golder, 1996; $USFS 1992; $$USFS, 2001; Schafer, 1992; Schafer, 1996,*

*ABA-Acid Base Account* | *ABA = NP-AP* | *NP-neutralization potential* | *AP-acid generation potential* | *reported in tons per 1000 tons rock equivalent calcium carbonate*

*EPA TOX - EPA Toxicity Test, EPA Method 1310* | *TCLP-Toxicity Characteristics Leaching Procedure, EPA Method 1311* | *SPLP- Synthetic Precipitation Leachability Procedure , EPA Method 1312;*

*n = number of samples* | *nd - data not available* | *nr - mean value not relevant* | * Tailing sample from Troy | % percent

Results of whole rock analyses of ore from the Montanore sub-deposit are summarized in Table 74 along with results for ore samples from the Rock Creek sub-deposit and the Troy mine. At Montanore, total sulfur ranged from 0.01 to 1 percent and averaged 0.29 percent (n=35). Total sulfur ranged from 0.01 to 0.78 percent (averaging 0.25 percent) at the Rock Creek sub-deposit (n = 34) and from 0.06 to 0.31 percent (averaging 0.2 percent) at the Troy Mine (n = 16).

Thirty-five ABA (n= 35) tests have been provided for samples of ore from Montanore drill core. An additional 36 Rock Creek and 17 Troy Mine ore samples were analyzed for acid base account, as summarized in Table 74. The Montanore sub-deposit static test data indicate that the ore has uncertain potential to generate acid, with an average acid-base potential (ABP) of -4 T/kT $CaCO_3$ (with values ranging from -24 to 11 T/kT $CaCO_3$) and an NP:AP ratio of 0.8. MMC reports an ABA value for an individual representative sample of Montanore ore as -3 T/kT $CaCO_3$ (Geomatrix 2007b). Values for the Rock Creek and Troy samples have an average ABP of 5 T/kT $CaCO_3$ and 8 T/kT $CaCO_3$, respectively, in spite of low total sulfide.

Static tests of acid generation potential are based on nitric acid digestion of all available sulfide from a finely ground rock flour. As noted previously, this conservatively estimates the potential for oxidation of encapsulated sulfides, as well as the potential for sulfides to generate acid because all sulfide is assumed to be acid-generating pyrite. The use of an acid base account without adjustment thus overstates the potential for acid generation by the copper sulfide minerals and ignores the effects of encapsulation. For this reason, in its study of the Rock Creek sub-deposit, the DEQ appropriately reduced the total sulfide by the amount of sulfur that would correspond to the measured copper concentration (based on the assumption that all sulfide is chalcocite, $Cu_2S$, so that there is one atom of sulfide for every 2 atoms of copper) to account for non-acid generating copper sulfides (DEQ 1996). The DEQ therefore adjusted the total reactive sulfur using the copper assays, reducing the estimated sulfur content for the Rock Creek sub-deposit from an average of 0.26 weight percent to 0.1 weight percent, as shown in Table 74. The average for the Troy Mine was similarly reduced from 0.18 to 0.04 percent. Because copper concentrations were not reported for the Montanore sub-deposit samples that were analyzed for total sulfur, this correction cannot be made, although the principle is equally valid for the Montanore portion of the Rock Creek-Montanore deposit and would result in a predicted average value around 0.1 percent. The significant difference in inferred acid generation risk with and without this important mineralogical correction to account for non-acid generating copper sulfides is evident in Figure 62 and Figure 63.

The neutralization and acid generation potential of samples from the Montanore sub-deposit are compared to the regulatory NP:AP ratio guidelines (acid < 1 <uncertain< 3 < non-acid) in Figure 62. These data, which are also based on the conservative assumption that all sulfide is acid-generating pyrite, suggest that most samples have potential to generate acid or are uncertain in terms of ARD risk. These data overestimate the acid generation potential of the Montanore sub-deposit, which would more closely resemble the trends shown in Figure 63 for the Rock Creek and Troy deposits if Montanore data could be adjusted to account for acid-consuming copper sulfide minerals.

Another important source of data characterizing sulfide content is the thousands of ore intercepts that were assayed for copper and silver, operationally at the Troy Mine and for validation of the Montanore, Rock Creek and Troy claims. Given the very consistent copper sulfide mineralogy of the ore, it is possible to calculate the range of sulfide content based on the assumption that the copper to sulfur ratio of 2:1 for chalcocite, $Cu_2S$, represents the ore grade chalcocite

mineralization. MMC compiled assay data for 213 samples of ore from Forest Service claim validation studies for the Montanore Project, along with 347 samples from the Rock Creek claims, and 282 samples from the Troy claims, as shown in Figure 64. (Maxim Technologies 2003). Very few samples have a calculated sulfide concentration above 0.4 percent in any one of the deposits, and the average sulfide concentration is less than 0.2 percent. This distribution agrees with the results reported by DEQ (1996). Also, 89 percent, 94 percent, and 89 percent of samples (for the Troy, Montanore, and Rock Creek claims, respectively) have total sulfide concentrations below 0.3 percent, which is a commonly accepted cutoff value below which potential acidification is not of concern (Jambor *et al.* 2000, Price *et al.* 1997). In other words, although concentrations above this commonly accepted threshold of 0.3 percent do occur, they represent a consistently small fraction of the studied population in both the Troy and Rock Creek-Montanore deposits.

The potential for acid generation at the proposed Montanore Project was tested for an ore composite in a standard humidity cell test (Schafer 1992). The ore composite, which had an uncertain acid generating potential with an ABA of -14.5 T/kT $CaCO_3$, showed a low amount of oxidation with a final pH of 7 and low concentrations of sulfate and acidity (Geomatrix 2007b). In the composite leachate analyzed in week 6, a low copper concentration was detected; both copper and manganese were detected in week 12 (Geomatrix 2007b, Table B2). Results of this single analysis support the conclusion that Montanore ore would not be acid generating but may release trace elements at a near-neutral pH, and therefore agree with empirical water quality data from ore exposures in the Troy Mine (Geomatrix 2007b), which show no ARD, near-neutral pH, and low concentrations of copper and manganese.

Additional whole rock analyses were conducted using the alkali fusion method for one sample from the Montanore sub-deposit (Geomatrix 2007b). Whole rock analyses using a four acid ALS Chemex method MEMS61 also were completed for 12 additional Rock Creek ore samples (Maxim Technologies 2003). These data indicate that ore from these deposits is anomalous in copper, silver, and lead (Table 74).

Tests of metal mobility are more suitable for prediction of trace element release than simple whole rock digestions, regardless of digestion method. Two individual tests of metal mobility were run for ore from the proposed Montanore Project, each using a different method. One sample tested in a humidity cell indicated neutral pH with low concentrations of copper (0.02-0.04 mg/L) and manganese (0.03 mg/L) (Schafer 1992). In another test of Revett ore from the Montanore deposit using the EPA Method 1311 (Toxicity Characteristic Leaching Procedure, TCLP) analysis, barium, copper, and lead were detected in the leachate. The TCLP analysis is a conservative test designed more for waste classification than for prediction of environmental mobility, which would be expected to yield higher metal concentrations due to the types of conditions created in the test. No laboratory tests of metal mobility for ore from the Troy Mine were conducted, but water monitoring in the adit provides a very useful measure of potential trace metal release from ore and waste rock exposed together in underground workings. Comparison of dissolved and total water concentrations from the Troy adit (where ore was exposed underground) suggests that very low concentrations of some dissolved metals (copper, silver, lead, and manganese) may be detected in solution, but the majority of detected metals (aluminum, arsenic, silver, barium, copper, lead, manganese, and zinc) are associated with sediment (Enviromin 2007). This association makes the Troy data a conservative basis for assessment of the Montanore mine, because the Troy adits are inclines where there is little potential for settling of solids prior

to discharge. The adits at Montanore would be declines, with water draining into the workings where solids can settle prior to discharge.

The association of metals with suspended sediment in mine and adit water raises important considerations for water management. For example, the total copper concentration is predicted to average 30.9 mg/L, well above the dissolved concentration of 0.075 mg/L, based on data from the Troy adit in 1987. Copper concentrations in the discharge from the Troy Mine underground workings and adits decreased to an arithmetic mean of 0.15 mg/L during an interim closure (1993-1998, Geomatrix 2007a, Table 15). Following permanent closure of the Troy Mine, rebound of the water table during the 50 years following mining would reduce oxidation in the workings by orders of magnitude, because the dissolved concentration of oxygen in water is 10,000 times lower than in air. Construction of portal plugs and backfilling between the plugs would reduce available oxygen by reducing rates of ground water recharge with aerated surface water. Further, the rate of ground water movement through the mined workings would be slower, reducing the amount of suspended sediment that can be transported. The total copper concentration would be reduced under these conditions, to concentrations likely to be similar to those observed during interim closure condition in the Troy and Libby Adits, as described in Table 15 of MMC's MPDES application (Geomatrix 2007a).

Increased concentrations of nitrate are expected to be produced in blasted zones. At the Troy Mine, operational nitrate concentrations in water at the mine portal ranged up to 22 mg/L (USDA Forest Service *et al.* 1992, Table 6-14; Geomatrix 2007a). Post-operational concentrations at Montanore are predicted to be less than 8.8 and averaged 3.8 mg/L (USDA Forest Service and DEQ 2001). Predicted chemistries provided by MMC in their MPDES analysis for nitrate and ammonia concentrations in adit and mine water during construction (Geomatrix 2007a, Table 13) are based on Libby Adit and Troy Mine adit data collected during construction and mining operations. MMC predicted mean operational concentrations of nitrate in drainage from blasted rock exposed in adits would vary between 23 mg/L (the geometric mean) to 41 mg/L (the arithmetic mean) based on 97 measurements of water quality from in the Libby Adit that ranged between 2 to 310 mg/L). Ammonia is also predicted to be elevated (15.7 to 26.9 mg/L) during construction, with lower concentrations (0.69 mg/L) following construction. Post-construction discharge from ore zones are represented by chemistries measured in the Troy adits during interim mine closure from 1993-1998 (Geomatrix 2007a, Table 13). MMC has proposed to use emulsions with lower nitrate solubility to replace ammonium nitrate (ANFO-type) explosives, as a means of reducing nitrate and concentrations in adit/mine water during construction and operations (Geomatrix 2007a).

*Tailings*

Tailings chemistry is dominated more by the metallurgical process of sulfide and metal removal than by minor differences in the sulfide mineral content of ore, particularly within the very narrow range of sulfide content observed in Revett-style deposits. The process MMC proposes to use at the Montanore mill involves conventional flotation of rock ground to a range of particle sizes comparable to that proposed for the Rock Creek mill and in use at the Troy mill (MMI 2005a, MMC 2008). The ore would be finely ground, so that surface area available for interaction between the ground ore and water is greater than in the intact quartzite matrix, to optimize sulfide recovery during flotation.

The acid generation potential of tailings from the Rock Creek sub-deposit (11 T $CaCO_3$/kT) and the Troy mill (5.3 T $CaCO_3$/kT) were described in the original Montanore Project Final EIS (USDA Forest Service 1992). Chemistry for one tailings sample was reported for the Montanore Project (Schafer and Associates 1992) and additional data have been collected for both the Rock Creek and Troy Mines (Table 74). The tailings composite tested in a humidity cell had an ABA of 8 T $CaCO_3$/kT with an NP/AP ratio of 25.8 (Schafer and Associates 1992). Values reported by Golder (1996) for Troy mill tailings reduce the average ABA value to 2.8 T $CaCO_3$/kT in Table 74. Both the tailings effluent for the Montanore ore sample and water from the Troy tailings pond show neutral pH values and comparable (generally low) concentrations of major cations and anions, with excess alkalinity (Table 3). These results agree with those obtained during humidity cell tests, which show near-neutral pH and low level metal release.

The measured total sulfur values reported for tailings in Table 74 range from 0.01 to 0.08 percent. Additional testing of tailings generated through metallurgical testing of ore from archived Rock Creek core indicated copper recovery ranging from 75 to 99 percent with an average of 91 percent and sulfide recovery ranging from 80 to 99.2 percent, with an average of 94 percent (Maxim Technologies 2003). Whole rock analysis of the Rock Creek tailings subsamples was at or below detection at 0.01 percent sulfur for 13 of 14 samples; the fourteenth sample had a sulfur content of 0.02 percent. Although sulfide recovery was not measured for the Montanore ore metallurgical test, the copper recovery reported for the Montanore ore ranged from 86 to 97.5 percent and averaged 93 percent (Geomatrix 2007a). This value lies within the range of copper values reported for the Rock Creek ore. Given the similar average copper recovery, it is reasonable to assume that sulfide recovery would comparable to the values reported for Rock Creek and would yield similarly low residual sulfide values. Removal of 90 percent of the sulfur shown for the Montanore ore in Figure 64 suggests that less than 0.03 percent sulfur (average) would occur in the homogeneous tailings. The total sulfide content of rock in the ore zone ranges from below detection to 1.4 percent with the majority of samples below 0.4. Removal of 90 percent of the sulfide during processing yields a limited range of sulfide values between 0.002 and 0.15 percent, values which would have essentially no acid generation potential. Similarly, the copper and silver content of the ore also would be reduced to one-tenth of the original concentrations. The overall risk of ARD formation by tailings from Montanore after several hundred years is estimated to be low (Klohn Crippen 2005).

Although the NP/AP ratios for the Troy tailings ranged from <0.2 to 3.33, with an average value of 2.1, and therefore suggest potential for ARD formation, the sulfur concentrations measured in tailings was less than 0.1 percent. Such a low concentration of sulfide is unlikely to generate acid. The reported ratio values therefore reflect the sensitivity of ratios calculated for low NP and AP values, which can vary significantly when values in the numerator or denominator are small, and do not necessarily indicate acid generation potential. Further, water from the Troy tailings impoundment is not acidic after nearly 20 years of monitoring (Table 75).

The similar mineralogy and range of silver and copper assay values for the Rock Creek-Montanore and Troy deposits, as well as the use of the same flotation method for all three mills, implies that tailings chemistry would be comparable at the three mines. This is confirmed by results of humidity cell tests of ore (prior to removal of sulfide by flotation) from the Montanore and Rock Creek ore, which were not acid generating and released little to no trace metal (Schafer and Associates 1992, 1997). Synthetic Precipitation Leaching Procedure (SPLP) testing of tailings from Troy indicates that tailings seepage would not yield highly elevated metal-enriched leachate, although the metals barium, chromium, copper, iron, lead, manganese, and zinc were

**Table 75. Tailings Effluent Water Chemistry.**

| Parameter | Troy Tailings Impoundment† Arithmetic Mean | | Montanore Tailings Impoundment Effluent‡ |
|---|---|---|---|
| pH – lab, s.u. | 7.5 | | 7.5 |
| Specific Conductivity – lab, µmhos/cm | 366 | | 214 |
| hardness | 72 | | — |
| Total Dissolved Solids | — | | 131 |
| Calcium | 19 | | 12 |
| Magnesium | 6 | | 2.3 |
| Sodium | 20 | | 12 |
| Potassium | 29 | | — |
| Chloride | 6 | | 6.1 |
| Sulfate | 23 | | 12 |
| Alkalinity (bicarbonate) | 80 | | 76 |
| Nitrate | 15.9 | | — |
| Ammonia | 7.2 | | — |
| **Metals** | **Total** | **Dissolved** | — |
| Aluminum | 0.5 | — | — |
| Arsenic | 0.02 | <0.005 | — |
| Cadmium | 0.0017 | 0.002 | — |
| Copper | 0.8 | 0.037 | — |
| Iron | 2.3 | 0.05 | — |
| Lead | 0.126 | 0.015 | — |
| Manganese | 1.9 | 0.429 | — |
| Mercury | 0.0005 | 0.001 | — |
| Silver | 0.0042 | 0.004 | — |
| Zinc | 0.078 | 0.019 | — |

All units are milligrams per liter (mg/L) unless otherwise noted.
s. u. = standard units.
µmhos/cm = micromhos per centimeter.
†After data presented in Table 17, Geomatrix 2007a.
‡After data presented in Table 16-9, MMI 2005a.
"—"= Data not reported.

detected at low concentrations (Golder 1996). Analysis of tailings liquids obtained in bench scale flotation tests of Rock Creek ore indicated a similar suite of detectable total barium, cadmium, lead, silver, copper, manganese, iron, and aluminum. Of these elements, manganese, iron, and aluminum were detected in concentrations suggesting that some changes in tailings water quality above secondary maximum contaminant levels (SMCL) values for iron and manganese may occur during operations, when colloidal and suspended solids are entrained in tailings water (Maxim Technologies 2003). Humidity cell test data indicated elevated concentrations of copper, iron, lead, manganese, and zinc under neutral pH conditions. The potential for such changes in metal concentration, as observed in tailings water and monitored ground water below the Troy impoundment, would be the same at the Montanore tailings impoundment. MMC would collect tailings seepage and return it to the impoundment during operations and at closure until it met water quality standards.

As additional samples become available for metallurgical testing during final exploration and early operations, a more representative set of samples would be available for testing. Additional testing of acid generation and metal release potential would be completed for the samples, to supplement the kinetic test data available from a single humidity cell test. Any analyses based on pilot scale metallurgical tests would be more consistent than would be expected under processing plant conditions, where variations in efficiency and recovery are not only anticipated but documented daily. Such monitoring can be used to check for changes in sulfide content of tailings during operations.

*Waste Rock*

According to MMC, 2.01 million bank cubic yards (M bcy) of waste rock would be generated by the Montanore Project throughout mine life (Geomatrix 2007b). MMC estimates that 0.75 M bcy would be produced during construction, from the Prichard Formation (0.44 M bcy), the Prichard-Burke transition zone (0.05 M bcy), the Burke Formation (0.08 M bcy) and the lower Revett Formations (0.17 M bcy). About 75 percent of this rock would be used for tailings impoundment dam construction, with the remaining 25 percent used underground as backfill. Waste rock also would be used to construct portal pads and the plant site. Waste rock used for construction would be stockpiled temporarily at LAD Area 1, along with ore produced during development work. A detailed description of waste rock production, handling, placement, and management is provided in MMC's waste rock management plan (Geomatrix 2007b).

The first waste rock (0.1 M bcy) to be produced would come from the Burke and lower Revett Formations, where they would be exposed in the Libby Adit. Waste rock from the zones of the lower Revett Formation in these workings would include rock from the *chalcopyrite-calcite* and *pyrite-calcite* alteration halo zones, as well as the *galena-calcite* halo (barren lead zone), although the proposed mining method would minimize production in the barren lead zone operationally. About 0.3 M bcy of additional waste rock would be mined from the Prichard, Burke and Wallace Formations during construction of the Ramsey Adits, which may have variable mineralogy and chemistry between the Rock Creek-Montanore and Troy deposits. Six geologically distinct units would therefore be mined as waste rock, three from the Revett Formation and one each from the remaining formations, which are listed above. An estimated 0.7 M bcy of lower Revett Formation waste rock would be generated during preproduction development of the underground crusher station, main stopes, haulage drifts, ore/waste passes, and access ramps, and would be used for constructing portions of the tailings dam, the mill facility, and the Ramsey portal area. An additional 0.41 M bcy of initial production waste rock also would be used to build the tailings starter dam. The remaining 0.5 M bcy of production waste rock would be placed underground as backfill in mined-out areas (Geomatrix 2007b).

Of the three Montana Revett-style mine projects, the majority of waste rock characterization was completed for the Montanore Project. The only reported data for the Prichard and Burke Formations are from data collected for the 1992 Montanore Project Final EIS (USDA Forest Service *et al.* 1992). A total of 155 acid base account analyses have been reported for the Revett, Prichard, and Burke Formations in the Montanore sub-deposit, as shown in Table 74. A smaller number of waste rock samples (n=28) also were characterized for the Rock Creek sub-deposit.

***Prichard and Burke Formations***. Acid generation and neutralization potential data for 89 samples of Prichard and Burke Formation waste rock from the Libby Adit at Montanore (USDA Forest Service *et al.* 1992, reported by Geomatrix 2007a, Table A-6) suggest that these waste rock

lithologies have variable potential to generate acid and release trace elements at a near-neutral pH. The Prichard Formation acid base potential varies from -20 to 54 T/kT $CaCO_3$ (NP:AP 0.1 to 43), with an average ABP of 7 T/kT $CaCO_3$ (NP/AP 3.7) for 70 samples. The Burke Formation (which in this summary includes the Burke-Prichard transition zone) has an acid base potential that varies from -6 to 49 T/kT $CaCO_3$ (NP:AP 0 to 49), with an average ABP of 15 T/kT $CaCO_3$ (average NP/AP equals 12) for 19 samples. More detailed analysis of these data are provided in a geochemistry technical summary report (Enviromin 2007). These data suggest that most of the Prichard Formation rock exposed in the adits has uncertain potential to generate acid and release metals and show that roughly half of the samples have total sulfur contents above 0.3. Portions of the Prichard Formation should therefore be considered to have uncertain potential to generate acid and release metals. The Burke Formation does not appear to have as great a potential for acid generation and trace element release, but it is more difficult to be conclusive because many of the samples come from the blended transition zone (both Burke and Prichard Formations together) where the individual lithology is unclear in the data. Because the sulfide mineralogy of the waste rock units is more variable and complex than in ore, this interpretation is, appropriately, based on the assumption that all sulfide is reactive for the purpose of evaluating acid generation potential.

Two humidity cell tests of Prichard Formation waste rock from the Montanore sub-deposit were reported by Schafer and Associates (1992) and are summarized by Geomatrix in Tables B-1, B-2, and B-3 (Geomatrix 2007b). One sample of Prichard Formation waste rock had a moderately low ABP value of -2 T/kT $CaCO_3$, while the second had a relatively higher ABP of 18 T/kT $CaCO_3$. Although pH of effluent started around pH 7 for both cells, final pH was 6.9 with low conductivity and sulfate concentrations for both cells. The humidity cell test with lower ABP did produce more sulfate over the life of the test, along with higher acidity which exceeded alkalinity late in the 20 week test.

These kinetic test data, which do not support acid generation from the Prichard Formation, agree with the monitoring data from the Libby Adit, where sulfide oxidation does not appear to be occurring in the exposed portions of the Prichard and Burke Formations within the Libby Adit after 10 years of exposure (Geomatrix 2007a, Table 16). Sulfate concentrations reported in 1997, 1998 and 2007 were less than 23 mg/L, indicating that few reactive sulfides are oxidizing to form sulfate. The average pH in the Libby Adit water has remained consistently neutral. In 1993, the reported pH was 7.7, while in 1997 pH ranged from 6.6 to 7.9 and averaged 7.4. In 1998, pH ranged from 7 to 8.6 and averaged 7.6. Elevated nitrate concentrations and two low mercury concentrations in 1997 decreased to near background concentrations or were not detected in 1998. Together with the humidity cell data, this information suggests that static tests may over-predict acid generation potential for the Prichard Formation.

There are no metal mobility tests of waste rock samples from the Prichard and Burke Formations at the proposed Montanore Project. Metal concentrations in humidity cell effluent for two tests of the Prichard Formation waste rock showed low, but detectable concentrations of arsenic, iron, manganese, and zinc (Geomatrix 2007b). Occasional low concentrations of iron, manganese, and zinc were detected in Libby Adit water during 1997 and 1998 (Geomatrix 2007a). Low dissolved metal concentrations were found in a sample collected in 2006 (MMC 2006).

***Lower Revett Formation.*** Whole rock data (analysis by the alkali fusion method) for three representative samples from the lower Revett Formation waste rock (hanging wall, foot wall, and barren zone) and an average for three samples collected from the Rock Creek waste rock (analysis by previous unknown method) are summarized by Geomatrix (2007b, Table A-1).

Whole rock data are presented for 14 additional samples of Revett Formation waste rock from the Rock Creek sub-deposit by Maxim Technologies (2003). These samples are variably enriched in copper, iron, lead, and zinc, depending upon style of alteration. No whole rock data were reported for lower Revett Formation samples collected from the Montanore sub-deposit.

Average acid-base potential for waste rock in the lower Revett Formation at the proposed Montanore Project ranges from 3.2 to 6.0 T/kT as $CaCO_3$ with NP values ranging from 2.2 to 4.6 (Figure 62). The average ABP for the lower Revett Formation waste rock is +4.2, with an NP/AP ratio of 3.5 for 66 samples. ABP data for quartzite, siltite, and silty quartzite waste rock from the Revett Formation at the proposed Montanore Project (Geomatrix 2007b, Table A-5), indicate less potential to generate acid than was observed for the samples collected from the Prichard and Pritchard/Burke transition zones exposed in the Libby Adit. The style of halo mineralization present in these rocks is not described for these samples, despite the potential importance of the sulfide variation in influencing potential to produce acid drainage. Because of the silica encapsulation of sulfide minerals within the Revett quartzite, static numbers are most likely conservative in estimating the true acid generation potential of the rock. Additional ABP analyses of composites of lower Revett Formation waste rock are summarized by Geomatrix (2007b, Table A-3).

The Rock Creek Project EIS described one waste rock composite (of three Revett Formation waste rock samples) that was analyzed for acid generation potential and was found to be net neutralizing, with an ABP of 11 and an NP/AP ratio > 11 (USDA Forest Service and DEQ 2001). The DEQ collected and analyzed 10 additional samples of waste rock from the Rock Creek sub-deposit (DEQ 1996). Half of these samples fall into the uncertain range based on NP/AP criteria (acid 1 < uncertain < 3 non-acid), and all of the samples fall into that category based on ABA (acid < - 20 < uncertain < + 20 non-acid) criteria. The non-sulfate sulfur concentration is low, ranging from 0.01 to 0.20 wt percent and averaging less than 0.1 percent in the 10 samples collected by DEQ. Three of the samples collected by the DEQ were from the Prichard Formation, with the remainder from the lower Revett quartzite.

During a third-party geochemical review of the Rock Creek Project funded by the Forest Service, 14 analyses of acid generation potential, whole rock metal content, and metal release potential were conducted to supplement the 12 analyses originally provided for samples of waste rock from the Revett Formation (Maxim Technologies 2003). These data, along with composites reported in the 1992 Montanore Project Final EIS, bring the total number of waste rock analyses for the Rock Creek sub-deposit to 28, as shown in Table 74; these samples have an ABP of 3.6 T/kT $CaCO_3$, with an NP/AP ratio of 5.8. A summary table comparing waste rock from the Rock Creek and Montanore sub-deposits is provided as Table A-7 by Geomatrix (2007b). The data illustrate the strong similarity in acid base potential and NP/AP ratios for waste rock to be mined from the two projects proposed for development within the Rock Creek-Montanore deposit.

Humidity cell tests of two samples of Revett Formation waste rock also were reported by Schafer and Associates (1992). These represent the hanging wall (with an ABP of -15 T/kT $CaCO_3$) and the barren lead zone (with an ABP of -1 T/kT $CaCO_3$). The hanging wall sample showed low sulfate release with an ending pH over 8, while the barren lead zone was consistently lower at pH 6. Both tests showed relatively high rates of acid production that exceeded alkalinity throughout the test and data indicate that these rocks, particularly the barren lead zone, have potential to generate acid.

Metal mobility for samples of Revett Formation waste rock has been evaluated using multiple test methods. Three TCLP analyses of Revett Formation waste rock are reported by Geomatrix (2007b, Table A-2), which contained low concentrations of barium, copper, and lead. An average chemistry for three EPA Toxicity (EPA Method 1310) tests of Revett Formation waste rock is also reported by Geomatrix (2007b, Table A-2), which had detectable calcium, magnesium, and copper. These results are similar to results reported for the whole rock metal analyses, the SPLP (EPA method 1312), and TCLP (EPA method 1311) metal mobility tests that were completed for the 14 Rock Creek waste rock samples described above (as reported by Maxim Technologies 2003 in Enviromin 2007). Apart from calcium and magnesium, no metals were detected in SPLP extracts of the waste rock, which uses an unbuffered weak inorganic acid extraction. Concentrations of copper and lead in the waste rock were detected in the more strongly acidic TCLP extractions, although at considerably lower concentrations than reported for the ore zone. Iron was also detected at a relatively high concentration (up to 29 mg/L) in the TCLP extraction (buffered pH 5 organic acid). In contrast, of the unbuffered SPLP analyses of the same waste rock, only one had a detectable iron concentration of 0.2 mg/L, well below the applicable standard. This indicates that the TCLP, a test designed for the identification of hazardous wastes rather than measurement of metal mobility, overestimates potential metal mobility due to the high acid concentration and the artificially lower pH of 5 used in the test.

Effluent from a humidity cell test of waste rock from the lower Revett Formation had low but detectable concentrations of copper and manganese (Schafer and Associates 1992). A humidity cell test of waste rock from a high grade portion of the lead-rich barren zone produced elevated concentrations of lead, manganese, and zinc. Portions of the barren zone have elevated concentrations of lead, and soluble copper and lead also were detected in weak-acid extracted samples of the lower Revett Formation. The suite of trace elements run for some of the metal mobility tests was limited and should be expanded during operational validation, by testing for a more complete suite of regulated trace elements.

In the Troy Mine, the overlying galena halo zone and the pyrite halo zone were not mined and are therefore not exposed in the workings, due to site-specific geological factors influencing mine facility design. Undisturbed, these zones are not creating acid rock conditions, as samples of the underground mine water following seepage through these zones consistently show neutral to slightly alkaline pH values between 7.2 to 7.4. The Troy Mine does have near-neutral trace element releases at this pH. None of the lower Revett rock was exposed in the Libby Adit, so it is not possible to evaluate its weathering chemistry using those monitoring data.

Nitrate concentrations are less affected by the primary mineralogy of the rock than by the blasting practices used in mining. The water quality data reported for the Libby and Troy adits during and after construction are representative of the chemistry that would be expected at the proposed Montanore Project. Post construction values reported for the Libby Adit in 1997 and 1998 ranged from below detection to 1.9 mg/L, and averaged 0.26 mg/L. Based on the plan for use of emulsion explosives, contributions of nitrate and ammonia are predicted at low/high concentrations of 15 and 25 mg/L nitrate and 5 and 10 mg/L ammonia, based on values measured at the Libby Adit during construction, but intermittent discharge of nitrate and ammonia in seepage would be likely. Post construction values reported for the Libby Adit in 1997 and 1998 ranged from below detection to 1.9 mg/L, and averaged 0.26 mg/L.

### Mine Drainage – ARD and Trace Element Release

The risk of acid generation for rock exposed in underground workings or for tailings would be low, with some potential for release of select metals at a near-neutral pH and a high potential for release of nitrate due to blasting. Low acid generation potential exists for a fraction of the total waste rock volume in portions of the Prichard Formation and moderate potential exists within in the halo zones of the Revett Formation, which MMC proposes to mitigate through selective handling (particularly of the barren lead zone) and further evaluation by sampling and characterization during mine development and operations. Portions of the waste rock at Montanore have the potential to release trace elements at a near-neutral pH.

#### *Ore in Underground Workings and Stockpiles*

As there has been no historical development of ore within the Montanore deposit, the proposed action would modify the existing underground environment. Ore would be exposed within the mine workings and stockpiled temporarily at the LAD Area 1, during construction of the tailings impoundment. Encapsulation of the sulfides in quartzite would limit the extent of sulfide oxidation within the stockpile and the majority of oxidized sulfide would not be acid generating. There would therefore be low potential for acid generation or trace metal release during the construction period when ore would be stockpiled. Any minor amount of metal (most likely, copper, manganese, and zinc) released into water as a result of stockpiled ore oxidation would be treated if necessary to meet MPDES limits before water would be discharged. During operations, ore would be shipped to the mill for processing where 90 percent of the sulfides would be removed.

Waste rock and ore that was not mined underground would remain exposed in the mine walls, where it would undergo oxidation where it is exposed to oxygen and air. The massive nature of the quartzite that hosts Revett-style ore at the Montanore Project would limit the relative reactive surface area of sulfide exposed to oxidation, which would be on the order of less than a few percent of the total surface area of sulfide contained in the rock. Such low exposed sulfide surface area within the quartzite, and the dominant presence of sulfides that are not acid generating, would substantially reduce the potential for acid generation by ore exposed underground. The small percentage of exposed sulfides would oxidize to form copper oxide and sulfate minerals with variable solubility, with potential to release metals into solution at a near-neutral pH. Results reported for dissolved metals in Troy adit/mine water are consistent with the metal release values reported for metal mobility and kinetic tests. Low concentrations of dissolved copper, manganese, and zinc are predicted for release by weathering ore and waste rock in the adit walls, with higher total recoverable concentrations that reflect the importance of sediment transport of metals. For this reason, water from the Libby and Ramsey adits would be treated prior to discharge to surface or ground water if necessary to meet water quality standards. The probable need for treatment is low, due to the configuration of adits at Montanore, which would have lower levels of suspended sediment than have been observed at Troy.

#### *Tailings*

Following grinding, pH adjustment, and removal of sulfide during processing, the homogenous tailings would have an elevated pH with a low sulfide content below 0.1 percent. Acid generation would be unlikely, but tests of metal mobility and monitoring at the Troy Mine suggest that some metals would be mobile in tailings effluent at a near-neutral pH, particularly during operations when suspended sediments may transport colloidal and adsorbed metals. These metals include copper, cadmium, iron, lead, silver, manganese, and aluminum. Nitrate and ammonia

concentrations also would be elevated. Only dissolved constituents have potential to move beyond the impoundment and potentially affect ground water and surface water quality.

*Waste Rock*

The environmental geochemistry data indicate that some portions of the lower Revett Formation have potential to generate acid, while others do not. Kinetic data support potential for acid generation from the lower Revett sulfide halos, particularly the barren lead zone that separates the two ore zones. While the risk would be mitigated by MMC's plan to limit mining of rock from the barren lead zone, this risk would need additional characterization through additional sampling and testing prior to waste rock placement as the Libby and Ramsey adits were advanced through the lower Revett halo zones. This would be particularly important for delineation of waste rock that would be used in construction of surface facilities.

Comparison of the static results with kinetic test data indicates that static test data overestimate the potential for acid formation from the Prichard Formation waste rock, a conclusion that is supported by the lack of acid drainage from the exposed section of Prichard Formation in the Libby Adit or from the rock stockpiled in front of the Libby Adit. This interpretation would need to be validated with additional sampling within the Prichard Formation prior to use of rock as construction material. Also, metal mobility should be better characterized for any rock to be used as construction material, regardless of acid generation potential. Waste mined from the Burke Formation appears unlikely to generate acid, although additional data would need to be collected for it to confirm preliminary conclusions based on the small number of samples studied previously from the Libby Adit. Samples of the silty carbonate-rich Wallace Formation, which has not been characterized in terms of acid generation or trace metal release potential, would need to be obtained for testing during adit construction as well. These characterization questions would be partially addressed by the waste rock management plan proposed by MMC.

#### *3.8.3.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative*

The risk associated with ore in underground workings and stockpiles in these alternatives would be the same as in Alternative 2. No major difference in potential for acid rock drainage or trace element release would likely result from the construction of adits in Libby Creek and not Ramsey Creek in Alternatives 3 and 4. Minor differences in the relative volumes of waste rock lithologies intercepted in the alternative adit locations that would be developed under Alternatives 3 and 4 may alter the overall potential for changes in water quality, depending upon the relative volume of Prichard and Revett Formation halo rock to be mined. Any change would likely be minor and would be identified through sampling and analysis during adit development. The chemistry of tailings and waste rock used for impoundment construction would not change as a result of constructing impoundments in alternative locations.

The volume of waste rock to be mined from each halo zone, and the area of the underground workings that would expose the halo zone, are not yet fully defined because final mine plans would depend upon results of proposed development work. As noted above, the potential for trace metal release from waste rock used in construction or placed in stockpiles, would primarily be a function of how much waste rock was mined from the reactive portions of the lower Revett Formation sulfide halos and the Prichard Formation, and how much metal those rock types would release. The described zonation patterns (in and of themselves) do not indicate a higher potential for acid generation and metal leaching at Montanore Project than that observed at the Troy Mine,

but suggest the need for sampling at a level sufficient to represent the observed variability. These relationships would be further defined in the Libby Adit evaluation program, when waste rock in these zones can be sampled more comprehensively, and would be used to support further testing. Ore collected during this development work should be used to conduct further metallurgical testing with a goal of obtaining tailings reject for kinetic and metal mobility test work using a comprehensive suite of elements. This would be needed to support the results of a single kinetic test of tailings reported to date, and to provide a more comprehensive suite of metal mobility data for evaluating tailings impoundment performance.

Some additional sampling would be conducted during final exploration and operations, when a more representative section of waste rock would be available for sampling. As shown in Table 74, characterization of metal release potential for tailings and waste rock is limited and would be expanded in Alternatives 3 and 4. Descriptions of mineralogy in rocks exposed in the evaluation adit ore zone (for the Revett Formation) and development adits (for the Burke and Prichard Formations) would be used to identify subpopulations with sulfide halo zone overprints and their relative importance in terms of tonnage to be mined, to guide sampling density. If the Wallace Formation were intercepted, samples of this lithology would be collected and characterized. This information would be used to redefine geochemical units for characterization and evaluate potential selective handling and encapsulation requirements.

Solute loading from waste rock was not incorporated into MPDES models of water quality impacts (Geomatrix 2007a). Although waste rock would only be stockpiled for a short period of time near LAD Area 1, and runoff from that pile would only be contained using stormwater controls, waste rock would be used throughout the site for construction purposes, using selective handling criteria that are not yet defined. It is therefore not clear which fraction of the Revett Formation waste rock would be brought to the surface. Once more detailed information about the Revett and Prichard Formations waste rock is available, along with updated predictions of metal loading for tailings, these source terms should be incorporated into updated mass load calculations.

### 3.8.3.2 Topography and Geomorphology

#### *3.8.3.2.1 Alternative 1 – No Mine*

In this alternative, existing topography and geomorphology features would remain similar to existing conditions. The disturbances at the Libby Adit site would eventually be reclaimed. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

#### *3.8.3.2.2 Alternative 2 – MMC's Proposed Mine*

Under Alternative 2, changes to the existing topography and geomorphology would occur. Construction of surface facilities would alter the existing topography and surface drainage system at the Libby Creek and Ramsey Creek facilities, the LAD Areas, and at the Little Cherry Creek Impoundment Site.

Existing disturbance at the Libby Adit area includes cut-and-fill benches, a waste rock pile, and a percolation pond. The waste rock would eventually be used for construction of the tailings

impoundment. At the end of operations, the cut areas and percolation pond would be filled and waste rock from the bench would be backfilled into the adit for closure. Except for a small bench that would remain following mining operations, the post-mining topography would approximate pre-mining conditions. All drainage and diversion structures used during the operational period would be removed and the pre-mining drainage restored.

The Ramsey Portal and Plant Site also would be constructed using a cut-and-fill sequence with the fill supplemented with waste rock from adit construction. Cut slopes would be benched at 15- to 25-foot intervals. The channel of Ramsey Creek would not be altered. Following operations, the mine portal would be backfilled to the approximate original topography. Benches for the mill, electrical substation, and thickener would be graded into the existing hillside. All drainage and diversion structures used during the operational period at the mill site would be removed and the pre-mining drainage restored. Drainage on the remaining fill material would be riprapped if necessary to control erosion.

Two LAD Areas would be constructed adjacent to lower Ramsey Creek. Soil stockpiles, a waste rock stockpile, sediment ponds and a lined surge pond are proposed within the LAD Areas. Following operations, the LAD Areas and associated ponds and soils storage piles would be graded to match pre-mining topography.

The largest alteration of existing topography would be construction of a 620-acre tailings impoundment within the Little Cherry Creek drainage. The impoundment dam would have a height of about 318 feet. The Seepage Collection Dam, downgradient from the main impoundment dam, would have a height of 30 feet and would remain in place until water quality objectives were met. Following removal, the Seepage Collection Dam and Pond would be graded to blend in with the original slope. The tailings impoundment would remain as a permanent landform following mining operations.

Little Cherry Creek would be diverted 10,800 feet around the proposed impoundment and channeled to two unnamed tributaries of Libby Creek. One channel (Channel A) is about 6,200 long intermittent channel that currently flows primarily in response to snowmelt and significant rain events, with some reaches of perennial flow. Another channel (Channel B) is south of the lower reach of Channel A and is about 3,000 feet long. A control gate structure would be installed where Channel A and B join to control flow in both channels. An energy dissipater would be constructed at the outlet section of both channels to reduce flow velocity of water entering Libby Creek. MMC identified a variety of measures that may be used to control erosion and sedimentation and to create aquatic habitat (Geomatrix 2006b).

During operations, the former Little Cherry Creek channel below the tailings impoundment would no longer receive surface flows from above the Seepage Collection Dam. The unnamed tributaries to Libby Creek would be subject to increased flows and sediment load from the diversion. The Diversion Dam and Channel would remain a permanent feature. The Diversion Channel would cross the hill slope face, east of the tailings impoundment, before discharging into the unnamed tributary to Libby Creek. Post-mining, the North Saddle Dam would be removed and runoff would drain from the reclaimed tailings impoundment surface toward the Bear Creek drainage. The increased flow in Bear Creek is not expected to alter the channel's geomorphology. The drainage toward Bear Creek would be a permanent feature.

#### *3.8.3.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative*

The effect on topography and geomorphology of the LAD Areas and the Libby Adit Site in Alternative 3 would be essentially the same as Alternative 2. MMC would develop plans to shape slopes of the Libby Plant Site, mine portal areas, and Libby Adit Site to closely resemble the surrounding landscape. Final grading would involve regrading and shaping flat surfaces to blend with the adjacent landscape and have natural dendritic drainages. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms.

Construction of the Libby Plant Site on the northeast toe of the ridge between Libby Creek and Ramsey Creek would involve the grading and changing of current topography on about 110 acres. The construction of a level plant site on the toe of the ridge would require cut and fill to accommodate the plant area. Following operations, the mine portal would be backfilled to the approximate original topography. Like Alternative 2, benches for the mill, electrical substation, and thickener would be graded to match the surrounding hill slope. Based on preliminary analysis, no waste rock would be needed to construct the Libby Plant Site.

The largest alteration of existing topography would be construction of a 590-acre tailings Poorman Tailings Impoundment between Poorman and Little Cherry creeks. The impoundment dam would have a maximum height of about 360 feet. The Seepage Collection Pond, downgradient from the main impoundment dam would have a height of 30 feet. Four small, unnamed channels tributary to Libby Creek would be filled by the tailings impoundment. A large diversion channel around the impoundment would not be needed. The tailings impoundment and dam would remain as a permanent landform following mining operations. Post-mining impoundment runoff would be routed to a natural channel to Little Cherry Creek.

#### *3.8.3.2.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative*

Changes in topography and geomorphology at the Libby Adit Site, the Libby Plant Site, and LAD Areas would be the same as Alternative 3. The effect of the Little Cherry Creek Tailings Impoundment and Seepage Collection Pond would be the same as Alternative 2. MMC would develop plans to shape slopes of the Libby Plant Site, mine portal areas, and Libby Adit Site to closely resemble the surrounding landscape. Final grading would involve regrading and shaping flat surfaces to blend with the adjacent landscape and have natural dendritic drainages. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms.

During final design, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed channel and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. The channel would begin at the outlet of the engineered channel and would be designed to have the following characteristics:

- The diversion channel corridor would have a constructed floodplain and terrace that would allow passage of the 100-year flow volume
- The stream portion of the diversion corridor would be constructed to meet the 2-year flow event volume and approximate the cross-section, profile, and channel materials of similar sized watersheds found in the analysis area
- Establishment of fish habitat similar to that currently provided by Little Cherry Creek

These measures would increase the long-term stability of the channel. Post-mining, runoff from the impoundment surface would be channeled to the riprapped Little Cherry Creek Diversion Channel.

#### *3.8.3.2.5 Alternative A – No Transmission Line*

In Alternative A, the transmission line and substation for the Montanore Project would not be built. No changes to the topography or geomorphology would occur in Alternative A due to the transmission line. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

#### *3.8.3.2.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)*

Under the North Miller Creek Alternative, minor changes to the topography would occur during the construction of 9.9 miles of new access roads for structure installation. Proposed access roads in the tributary drainage of Miller Creek would cut into steep hill slopes, changing the slopes and slightly modifying hill slope drainage. Additional skid trails would be needed for timber harvest operations. All transmission line alternatives would cross and require roads in areas of steep slopes (those greater than 30 percent), or subject to slope failure. These areas are discussed in section 3.18, *Soils and Reclamation* and quantified in Table 134.

After transmission line construction was completed, available soil would be placed on the new roads and the road reseeded. The existing road prism would remain throughout mine operations until the transmission line was removed. After the transmission line was removed, all new roads would be bladed and recontoured to match existing topography, obliterating the road prism. Where culverts were removed, stream banks would be recontoured and reseeded. Over the long term, the transmission line would not substantially alter the area's topography or geomorphology, assuming construction did not destabilize slopes.

#### *3.8.3.2.7 Alternative C – Modified North Miller Creek Transmission Line Alternative*

Minor changes to the topography would occur during the construction of new access roads for structure installation in the Modified North Miller Creek Alternative. Use of helicopter construction for structures within the North Miller Creek area would avoid construction of roads in the steep areas of the tributary drainage of Miller Creek. About 3.0 miles of new access roads would be constructed in the lower elevation valleys to provide structure access.

After transmission line construction was completed, all new roads on National Forest System lands would be placed in intermittent stored service using a variety of treatment methods to achieve desired conditions for other resources. Newly constructed roads on Plum Creek lands would be gated after construction and managed as proposed by MMC in Alternative B. Plum Creek may require a newly constructed road be decommissioned after construction if adverse resource impacts occurred, such as on steep, erosive soils. Over the long term, the transmission line would not substantially alter the area's topography or geomorphology assuming construction does not destabilize slopes.

#### *3.8.3.2.8 Alternative D – Miller Creek Transmission Line Alternative*

In the Miller Creek Alternative, minor changes to the topography would occur during the construction of new access roads for structure installation. About 3.0 miles of new access roads would be constructed in the lower elevation valleys to provide structure access. Roads would be managed as in Alternative C. Over the long term, the transmission line would not substantially alter the area's topography or geomorphology, assuming construction does not destabilize slopes.

#### *3.8.3.2.9 Alternative E – West Fisher Creek Transmission Line Alternative*

In the West Fisher Creek Alternative, minor changes to the topography would occur during the construction of new access roads for structure installation. About 3.5 miles of new access roads would be constructed in the lower elevation valleys to provide structure access. Roads would be managed as in Alternative C. Over the long term, the transmission line would not substantially alter the area's topography or geomorphology assuming construction does not destabilize slopes.

### 3.8.3.3 Cumulative Effects

Both MMC and Rock Creek Resources, the owner of the Rock Creek Project, would mine stratabound copper-silver deposits from metasedimentary rock under the CMW. The combined size of both the Rock Creek and the Montanore ore bodies may be as large as 279 million tons. The mineral deposits are sufficiently isolated from each other that no cumulative changes to topography, geomorphology, mine drainage or trace element release would occur. Construction and operation of both mines would likely result in more stringent requirements on other future minerals activities in the area to ensure sufficient undisturbed habitat for several wildlife species. The result would be a slowdown in potential mineral exploration and permitting of potential future mineral developments in the area during the life of these projects (USDA Forest Service and DEQ 2001).

### 3.8.3.4 Irreversible and Irretrievable Commitments

Up to 120 million tons of ore would be removed by the Montanore Project, with the remaining 25 to 35 percent of the ore body left for structural support of the mine workings. The future recovery of the remaining metals left for structural support would be unlikely. Construction and operation of the Montanore Project would result in the irreversible commitment of these resources. Construction of a tailings impoundment in all action alternatives would irreversibly alter the area's topography and geomorphology. Alternatives 2 and 4 would irreversibly alter the drainage of Little Cherry Creek.

### 3.8.3.5 Short-term Uses and Long-term Productivity

Construction of mine facilities other than a tailings impoundment, and roads for all transmission line alternatives, in all action alternatives would alter the area's topography. These changes would be short-term and, and on National Forest System lands, the area's topography would return to the approximate original contour during the reclamation phase. On private land, Plum Creek may opt to retain the roads built for the transmission line.

### 3.8.3.6 Unavoidable Adverse Environmental Effects

The alteration of the area's topography and geomorphology in all action alternatives would be an unavoidable adverse effect.

## 3.9 Geotechnical Engineering

This section discusses the lead agencies' analysis of the risk of subsidence in the underground mine, and the stability of the tailings impoundment for Alternatives 2 and 4 (Little Cherry Creek) and Alternative 3 (Poorman). Also included in this section is a comparison of the two alternative tailings sites.

### 3.9.1 Analysis Area and Methods

Underground mining causes a redistribution of stress, which in turn causes displacements in the affected strata. Subsidence is the result of downward displacement of the rock mass from closure or collapse of underground openings. The analysis area for the subsidence evaluation is the area overlying the ore body. MMC completed a geotechnical evaluation of the potential for subsidence due to underground mining at the Montanore deposit (Call & Nicholas, Inc. 2005a). The lead agencies completed an evaluation of the project's potential for subsidence and to describe potential environmental impacts of subsidence if it were to occur (Agapito Associates, Inc. 2007b).

The analysis area for the impoundment stability analysis is Little Cherry Creek in Alternatives 2 and 4, and between Poorman and Little Cherry creeks in Alternative 3. Klohn Crippen (2005) updated the original design of the proposed Little Cherry Creek tailings impoundment and all associated facilities, incorporating changes in technologies since 1990, and making design changes required by the lead agencies in their 1992 project approvals. The lead agencies developed a design for an alternative Poorman Tailings Impoundment Site between Poorman and Little Cherry creeks in Alternative 3 in sufficient detail to analyze the effects in this EIS.

### 3.9.2 Affected Environment

#### 3.9.2.1 Structural Geology and Tectonics

The Montanore Project site lies within the Libby thrust belt, which formed along the western edge of the North American Craton. The Libby thrust belt is one of a series of major north-northwest trending structural features north of the Lewis and Clark line, a major tectonic boundary within the Continental Plate in the western U.S. The Libby thrust belt is bounded to the west and northwest by the Moyie thrust system, and to the southwest by the Hope fault (Klohn Crippen 2005).

The Lewis and Clark line is a prominent fault zone comprising strike-slip, dip-slip and oblique-slip faults that extend from the vicinity of Wallace, Idaho to east of Helena, Montana. Faults in this zone have been intermittently active from Middle Proterozoic to Holocene time and have the potential to produce damaging earthquakes. About 12 major faults make up the Lewis and Clark zone and include the St. Marys-Helena Valley, Bald Butte, Ninemile, and Osburn faults, which have had right separation or slip ranging between 6.8 to 17 miles. Most of this displacement is thought to have occurred during Late Cretaceous time (Klohn Crippen 2005).

#### 3.9.2.2 Seismicity and Seismic Hazard

The analysis area is located at the northern end of the Intermountain Seismic Belt, which extends from southern Nevada northward through Utah and eastern Idaho and western Montana. In western Montana, the Intermountain Seismic Belt is up to 62 miles wide. The Intermountain

Seismic Belt is characterized by moderate to large earthquakes with shallow focal depths. Historical seismicity has concentrated along the Intermountain Seismic Belt, which extends as far north as Kalispell, located about 58 miles east of the impoundment sites. (Klohn Crippen 2005)

Five faults identified as being potentially active in the last 1.6 million years are located within 50 miles of the impoundment sites. The closest known potentially active fault to the Montanore Project site is the Bull Lake Fault, located about 11 miles west of the project site. The Bull Lake Fault was used to estimate the site seismicity and is summarized in Table 76 (Klohn Crippen 2005). The site is located in a moderately active seismic area. The design maximum credible earthquake (MCE) is a potential Magnitude 7.0 earthquake on the Bull Lake Fault, which results in a peak ground acceleration of 0.22 g. The fault is part of a series of northwest-southeast trending faults, although the activity along the fault is uncertain. Larger faults, which typically are associated with larger seismic events, are located farther away and do not control the design seismicity.

**Table 76. Maximum Credible Earthquake and Site Seismicity.**

| | |
|---|---|
| Magnitude (M) | M7.0 |
| MCE Assumed Epicentral Distance | 12 miles (19 km) |
| Source | Bull Lake Fault, classified as later Quaternary, <700,000 years old and potentially active. |
| Peak Bedrock Acceleration (average from attenuation relations) | 0.22 g(*) (average from attenuation relations) |
| Duration of Significant Shaking | 27 seconds |

*g = gravitational acceleration (32.2 ft/sec$^2$).
Source: Klohn Crippen 2005.

### 3.9.2.3 Avalanches and Landslides

Numerous avalanche chutes occur in both upper Libby Creek and Ramsey Creek valleys. The only facility within an avalanche chute path is the Libby Adit Site (Figure 47). Three avalanche chutes are near the Libby Adit Site. The Upper Libby Adit Site, proposed in Alternative 3, is between two avalanche chutes. Because of the high elevation of the chute tops and the narrow widths of the valleys below, avalanches can cross valleys and move up the opposite side.

No landslides or unstable slopes were identified near the Ramsey Plant Site, the Libby Adit, or the two tailings impoundment sites. Fine-grained soils derived from glaciolacustrine silts and clays are susceptible to slope failures if undercut. Section 3.18.3.1.2, *Glaciolacustrine Soils* discusses these soils in more detail.

## 3.9.3 Environmental Consequences

### 3.9.3.1 Subsidence

#### *3.9.3.1.1 Alternative 1 – No Mine*

No mining would occur; therefore, the potential for mining-related subsidence would not be present. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the

permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Potential subsidence from the Libby Adit would be mitigated by backfilling the entire adit length that occurs in unconsolidated bedrock.

#### *3.9.3.1.2 Alternative 2 – MMC's Proposed Mine*

##### Summary

The lead agencies' evaluation (Agapito Associates, Inc. 2007b) concluded that chimney subsidence breaching the surface to form sinkholes is unlikely given the geotechnical setting and the mine plan proposed by MMC. Isolated roof failure and chimney subsidence to some height above the workings is likely, however, and resulting impacts to ground water should be evaluated. It is estimated that chimney subsidence impacts to ground water may occur up to about 400 feet above the mine workings. The agencies' evaluation concluded that trough subsidence, while not likely, cannot be entirely dismissed at the current level of design. Final design criteria would be submitted for the agencies' approval to help ensure that unplanned subsidence would not occur.

##### Introduction

Underground mining causes a redistribution of stress, which in turn causes displacements in the affected strata. Subsidence is the result of downward displacement of the rock mass from closure or collapse of underground openings. The terms "subsidence" and "surface subsidence" are generally used interchangeably; however, subsidence has the potential to affect ground water where it is encountered, even where subsidence has not progressed to the surface.

The magnitude and extent of mining-induced subsidence are directly related to the type and extent of the mining activity. In partial-extraction mining (such as the room-and-pillar method proposed for the Montanore Project), rock strength is estimated and pillars are sized and left permanently to support the overburden, so that subsidence is not planned to occur during active mining. Subsidence after mine abandonment due to time-dependent pillar, roof, or floor failure may still occur and may be the dominant form of subsidence in room-and-pillar mining without pillar recovery (Singh 1992). Residual subsidence may occur tens or even hundreds of years after active mining (Thorburn and Reed 1977; Mahar and Marino 1981).

The two major modes of subsidence associated with mining are chimney subsidence and trough subsidence. Chimney subsidence is associated with roof collapse over small areas, such as individual drifts (Figure 68). The collapsed strata cave progressively upward toward the surface, in a chimney-like fashion, until either the increased volume of the caved material arrests cave progression, or caving breaches the surface. If chimney subsidence breaches the surface, a sinkhole is formed. Trough subsidence, in which a subsidence basin is formed above caved and sagging strata, occurs over larger areas (*e.g.*, many acres) and is associated with wide-scale pillar, roof, or floor failure. This may include pillar punching into the roof or floor.

##### Geologic Setting

The ore deposit at Montanore occurs in two nearly parallel zones within the lower Revett Formation, part of the Belt Supergroup. The upper zone of the ore deposit is designated the B-1 Zone and the lower is called the B Zone. The average thickness of the B-1 Zone is 30 feet, while the B Zone averages 34 feet. A barren zone, ranging in thickness from 0 to 200 feet and averaging about 30 feet, separates the two ore zones. The orebody lies on the lower limb of an overturned syncline (Figure 58) that plunges to the northwest. The syncline is bounded to the west by the Rock Lake Fault, a steeply dipping normal fault, and to the east by the Libby Lake Fault.

Orebody dip follows the northwest plunge of the syncline, and ranges from about 5° to 50°. Dimensions of the orebody are approximately 2,000 feet wide by 11,000 feet long.

The lower Revett Formation consists primarily of quartzite with some siltite and silty quartzite beds. In addition to the Revett Formation, overlying rocks belong to the St. Regis and Wallace formations. The St. Regis Formation consists of siltites and argillites with some quartzite. The Wallace Formation consists of argillite, siltite, limestone, and dolomitic quartzite. Additional information about the geology of the mine area is found in section 3.8.2.1, *Geologic Setting.*

Several lakes exist over or adjacent to the orebody, including Rock Lake on the extreme southern end of the deposit (the orebody outcrops beneath and near Rock Lake), St. Paul Lake on the northern end, and the Libby Lakes near the eastern boundary. Additional information about the surface water resources in the mine area is found in section 3.11.3, *Affected Environment.*

Two other economic copper/silver deposits exist in the general vicinity of the Montanore Project. The Troy Mine (Spar Lake deposit) was permitted in 1979 and was in production until 1993 (U.S. Forest Service and Montana DEQ 2001). The mine was reopened in 2004, and was on maintenance status in the interim (Tetra Tech and R Squared 2006). The Rock Creek Project west of the Montanore Project currently is in the evaluation phase. Although these deposits are structurally different than the deposit at Montanore, the mineralogy of the ore zone at the three deposits is essentially identical (U.S. Forest Service and Montana DEQ 2001).

### MMC's Plan to Minimize Subsidence

MMC has indicated that pillar and opening dimensions would be designed with the goal of preventing surface subsidence. Spans of about 40 feet to 45 feet are planned. A pillar design study (Call & Nicholas 2005a) recommended 62-foot-long pillars, 40-foot-wide openings, and pillar widths varying from 19.5 feet to 49 feet, including 2 additional feet of both width and length to compensate for blast damage. These pillar widths were based on the Wilson pillar design approach (Wilson 1972) and a 1.3 safety factor. Required pillar widths would increase with cover depth (the amount of rock overlying the mine) and pillar height. The Call & Nicholas pillar design study provided for a cover range of 1,000 feet to 3,800 feet. As part of the Libby Adit evaluation phase, MMC would conduct additional underground core drilling before developing final mine plans. The drilling would be used to collect detailed information on underground geologic structures, ore thicknesses, ore grades, and hydrology. MMC has not proposed any secondary recovery, or "pillar robbing," at the end of mining, and any change to the final mine plan would require the agencies' approval. Additional information about MMC's mine plan is discussed in section 2.4.2.1, *Mining.*

The thickness of the unmineralized zone overlying the ore body ranges from zero (0) feet at the outcrop at Rock Lake to about 3,800 feet near Libby Lakes (Agapito Associates, Inc. 2007b). Most of the ore body is overlain by between 2,000 and 3,500 feet of cover. To reduce possible subsidence risk and the interception of ground water in the potential subsidence area, MMC plans to observe a 500-foot vertical and horizontal buffer zone at the outcrop near Rock Lake. In addition, a 100-foot barrier pillar is planned as a buffer to the Rock Lake Fault. It is anticipated that additional developmental drilling would better define the fault zone and, thus, the limit of mining near the fault and lake. MMC may use a narrower barrier, with the agencies' prior approval, should additional testing determine that a smaller buffer zone would be adequate to protect against subsidence and/or hydrologic disturbance. Alternately, the additional testing may

indicate that a larger buffer zone would be necessary and MMC would be required to stay farther from the fault and/or lake.

**Potential for Chimney Subsidence, and Likely Effects Were it to Occur**

Due to the depth of cover over the mine workings, it is unlikely that chimney subsidence would breach the surface to form sinkholes (Agapito Associates, Inc. 2007b). Some roof failure at mine level would be likely over time, especially after mine abandonment. Caving propagation (incremental upward movement) to some height above the workings would likely occur. Should such caving occur, MMC's estimates of final cave height are between 150 feet and 380 feet, or 2.1 to 5.4 times the assumed maximum 70 feet mining height (Call & Nicholas 2006). Due to the thickness of rock overlying the Montanore ore body, and the buffers proposed by MMC, these cave heights would not breach the surface. Any ground water intercepted by the caved strata would be rapidly transmitted to the mine workings. A fractured zone with increased hydraulic conductivity may exist for some distance above the caved zone, but given the likely diameter of the caved zone (a few feet to tens of feet), the thickness of the fractured zone would be limited and not likely to reach the surface based on the amount of rock overlying the ore. No other direct impacts are anticipated should chimney subsidence occur.

Two chimney subsidence events that resulted in sinkholes at the Troy Mine, located about 17 miles northwest of Montanore, have been reported (Tetra Tech and R Squared 2006). As discussed in section 3.8, *Geology*, the mineralogy of the ore zone at the Troy Mine is similar to that of Montanore. Sinkhole #1 was initially observed in October 1997 (Call & Nicholas 2005b), about 4 years after the mine had been shut down. At that time, the sinkhole was about 8 feet deep and 15 feet in diameter. By spring 2005, the sinkhole had increased to about 50 to 55 feet deep and 50 feet in diameter. At the mine level, material from the East Fault, a north-northwest trending normal fault that dips at about 65° to the northeast, had accumulated in two separate drifts sometime between the mine closing in 1993 and spring of 2005. Based on measurements of the accumulation of fault material in the mine, estimation of the sinkhole volume, estimates of fault gouge bulking factors, spatial relationships between the East Fault and the mine workings, and other factors, Call & Nicholas (2005b) concluded that the sinkhole was probably not related to underground excavation.

A second sinkhole formed in February 2006, and both sinkholes #1 and #2 were analyzed by Tetra Tech and R Squared (2006). Sinkhole #2 was about 135 feet long and 100 feet wide, with a depth between 20 and 30 feet. It was first noticed 4 days after a ground failure and cave in the underground workings of the Troy Mine. Based on projections of the East Fault to the surface, the location of the sinkholes relative to these projections, and on calculations regarding swell factor and chimney size, Tetra Tech and R Squared concluded that the sinkholes were mining related.

While relevant to the analysis of subsidence potential at Montanore, the formation of sinkholes above the Troy Mine does not imply a similar risk of sinkhole formation at Montanore. The mining depths associated with the two Troy sinkholes were 270 feet and 320 feet, respectively (Tetra Tech and R Squared 2006). Minimum mining depth at Montanore would be 500 feet. Assuming similar mining heights, the increased depth at Montanore would reduce the likelihood of sinkhole subsidence, as would MMC's plan to leave a 100-foot horizontal buffer between mining activity and the Rock Lake Fault. No such plan was required at the Troy Mine, where the East Fault was routinely approached and/or penetrated as part of the mining operation. Had a mitigation plan similar to the Montanore plan been in place at the Troy Mine, it is unlikely that sinkhole subsidence would have occurred (Agapito Associates, Inc. 2007b).

### Potential for Trough Subsidence, and Likely Effects Were it to Occur

MMC's design calls for stable pillars to be left in place, with no secondary recovery (retreat mining, or "pillar robbing"). If the design assumptions were met, trough subsidence and associated impacts would not occur. Any change to the final mine plan would require the agencies' approval. In order to quantify worst-case impacts, the remaining discussion in this section assumes that design assumptions were not met, and that trough subsidence occurred.

Trough subsidence over the workings due to unforeseen roof, pillar, or floor failure may result in maximum surface subsidence of 0.1 to 0.2 times the 70 feet mining height, or 7 feet to 14 feet. Surface subsidence would be much less than this if the width of failure at mine level were less than about 1.4 times the cover depth (Agapito Associates, Inc. 2007b). In this case, subsidence at the surface may be minimal or visually undetectable. If substantial surface subsidence were experienced, it would be measured over a surface area that somewhat approximates the area affected at mine level. The area affected at mine level is defined by the draw angle, the angle, in section, measured from the vertical, between the edge of the mine workings and the point on the surface at which subsidence is not detectable. A negative draw angle results in an affected surface area smaller than the area of failure, whereas the opposite is true for a positive draw angle. Based on case studies of initial draw angles in caving operations, it is estimated that the draw angle could vary from -12° to 28°. Using the latter as a worst-case scenario at maximum cover, subsidence could be measured for horizontal distances up to 2,000 feet beyond the footprint of failure. Surface damage is not likely to occur over the full angle of draw, but over the angle of critical deformation, which is typically about 10° less. Therefore, surface subsidence effects may occur up to 1,200 feet beyond the footprint of failure, based on an angle of critical deformation of 18°.

If design assumptions were not met and trough subsidence occurred, surface resources that may be affected include wildlife and vegetation, wetlands, and visual quality. Assuming this worst-case scenario, the lead agencies evaluation concluded the potential for impacts to these resources would be low (Agapito Associates, Inc. 2007b). The referenced report explains the conclusion in more detail.

### Possible Impacts to Ground Water

Subsidence has the potential to affect ground water where it is encountered, even where subsidence has not progressed to the surface. Chimney or trough subsidence would have the potential to affect surface and ground water in several ways and the effects of subsidence on the hydrologic regime can be highly variable and complex. Numerous case studies have been presented in the literature, and conflicting conclusions between studies are common (Peng 1992). The major factors controlling subsidence effects on hydrology include the horizontal and vertical distance between the caved zone and the water resource and the hydrologic properties of the intervening strata. The severity of hydrologic damage decreases with distance from the subsidence and the presence of low permeability stratum. Peng (1992) suggest an angle of influence of 16° to 26° is appropriate for estimating the distance beyond which hydrologic resources should be unaffected.

Within the angle of influence, hydrologic effects are expected to vary according to where water resources were intercepted vertically. If unplanned trough subsidence occurred, rapid transmission of any ground water to the workings would be expected in the caved zone, for a distance of 2 to 8 times the mining height, or 140 feet to 560 feet, assuming a total mining height

of 70 feet (Agapito Associates, Inc. 2007b). A fractured zone would exist over the caved zone, extending perhaps 1,400 feet to 2,100 feet above the mine workings. Increased permeability would be associated with the fractured zone, and permeability would increase from the top of the fractured zone downward. Above the fractured zone, surface fissures may develop, but they probably would not to extend to the fractured zone, as tensile stresses would likely die out and become compressive at some distance beneath the surface. Ground water flows may be affected from the surface to the fractured zone; any such interruption would continue until post-mining hydraulic heads stabilize.

As previously discussed, the caving height associated with chimney subsidence is estimated between 150 feet and 380 feet, or 2.1 to 5.4 times the assumed maximum 70 feet mining height (Call & Nicholas 2006). Ground water within this zone would be transmitted to the workings. Increased permeability above this zone would exist, although the zone of increased permeability would likely be of limited extent. The effect on ground water hydrology is discussed in section 3.10.4.2.1, *Mine Area.*

The potential for chimney or trough subsidence would be largely a function of mine design, and MMC has addressed subsidence risk in prior rock mechanics evaluations. MMC has proposed collecting additional underground geotechnical data as part of its Libby Adit evaluation program. The evaluation program would provide additional data to assess subsidence potential, the risk of trough subsidence, and the potential of fractures above the mine workings to affect ground water.

#### *3.9.3.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative*

Alternative 3 and Alternative 4 would have the same risk of subsidence and are discussed together. MMC would undertake additional measures regarding pillar design, structural setting, interaction of mine voids and pillars in the two ore zones, and roof support analyses to finalize the support plan and mining span. These measures are described under Alternative 3, section 2.5.3.7, *Subsidence*. MMC would submit a final geotechnical monitoring plan to the agencies for approval following the completion of the Libby Adit evaluation program. The most valuable geotechnical data are obtained during mining itself. A rock mechanics program that includes the agencies' mitigations on pillar design, structural geology, interaction between workings, and entry stability and support would reduce the potential for trough subsidence.

### 3.9.3.2 Impoundment Stability

#### *3.9.3.2.1 Alternative 1 – No Mine*

The risk of an impoundment failure and associated impacts would not exist. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

#### *3.9.3.2.2 Alternative 2 – MMC's Proposed Mine and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative*

The impoundment design in Alternative 2 would be the same as Alternative 4, and both alternatives are discussed together. Through the rest of this section, the impoundment design and

analysis is referred to only as the Alternative 2 design or impoundment. In Alternatives 3 and 4, during final design MMC would:

- Incorporate guidelines from the Idaho Administrative Code Safety of Dam Rules and the California Department of Water Resources, Division of Safety of Dams for seismic stability as appropriate
- Use more recent attenuation relationships that are based on instrumental records of attenuation collected in the United States and internationally (Spudich *et al.* 1999 and Boore *et al.* 1997)
- Conduct additional geotechnical investigations as needed to complete final design
- Complete circular failure plane assessments through the near-dam tailings and dam section and through the dam crest and slope
- Submit final design to the agencies for approval
- Fund a technical review of the final design by a technical review panel established by the lead agencies

The tailings impoundment dam in all alternatives would be considered by the DNRC as a high-hazard dam. The DNRC classifies a dam as high-hazard if it impounds more 50 acre-feet and the DNRC determines that a loss of human life is likely to occur within the flooded area as a result of failure of the dam. The hazard classification is based on the potential loss of life downstream and is not an assessment of the safety of the structure. Dams under a DEQ Operating Permit are exempt from Montana's Dam Safety Act.

MMC's design criteria are industry design standards for dam design and construction and have been established as measures of certainty for the design of safe earth and rock fill dams. The origin and basis of the criteria are founded in years of geotechnical engineering research, design, construction, and performance monitoring. These criteria are set and followed by the U.S. Corps of Engineers (1982a) and U.S. Bureau of Reclamation (1977) and serve as the design standards for State dam safety rules and regulations. The same standards also apply to soil and rock structures such as waste rock stockpiles, and cut and fill slopes.

**Site Seismicity**

The estimated Peak Ground Acceleration (PGA) of 0.22 g (Table 76) is sufficient to demonstrate the feasibility of providing dynamic stability in the layout and design of the tailings impoundment. The site seismicity would be re-evaluated during final design to ensure the estimated PGA is the most appropriate value for the Montanore site and for construction of a high-hazard dam. The PGA is the maximum rate of ground motion that will occur at a site. In MMC's analysis, PGA was based on occurrence of the maximum credible earthquake (Table 76).

MMC's estimated PGA value is the median (middle) probabilistic value obtained from several procedures used to estimate ground motion attenuation. The estimated PGA value is based on a given probability that a seismic event of a certain magnitude would occur at the site. If the probability of occurrence is changed, a new PGA is determined at the site. Generally, a higher probability of occurrence of an earthquake along a given fault results in a lower magnitude of earthquake and a lower PGA at the site. A deterministic PGA value (a selected PGA value based on the upper range of estimated ground accelerations regardless of the probability (percent chance) of the event occurring and impacting the site) may be more appropriate for the

Montanore tailings impoundment. This approach is consistent with seismic design guidelines for tailings dams (International Commission on Large Dams (1989) and the United States Committee on Large Dams (1999) (recommended design criteria by Klohn Crippen (2005)).

The design guidelines proposed by MMC (Klohn Crippen 2005) set the basis for a safe design and construction of the tailings impoundment. The references and agency guidelines cited by MMC, including the DNRC's dam safety regulations, do not provide specific standards with respect to seismic stability of large, high-hazard dams. The agencies' mitigation in Alternatives 3 and 4 would include incorporation of guidelines from other states, as appropriate, during final design.

**Stability**

MMC addressed the stability of the tailings impoundment dams through a series of minimum allowable safety factors against failure for static and dynamic loading conditions of the facilities (Klohn Crippen 2005). The factors of safety (FOS) for stability are summarized in Table 77. In addition, MMC completed a qualitative risk assessment of potential causes of failure of the tailings facility (Klohn Crippen 2005).

Included in the stability evaluation was a liquefaction analysis (the potential for a soil to act as a heavy fluid with little or no shear strength) to determine the locations of liquefiable or potentially liquefiable ground during the MCE of M7.0. The analysis was based on the number of hammer blows required to drive the soil sampler one foot (blow counts or 'n' values) obtained from Standard Penetration Tests (SPT) recorded during the different geotechnical field exploration work conducted in the Little Cherry Creek drainage basin. Under the Little Cherry Creek Tailings Impoundment Main Dam foundation area, the soils with SPTs that were found to indicate potentially liquefiable foundation materials are generally near the ground surface. The liquefaction assessment found that most of the foundation materials under the Alternative 2 tailings Main Dam are medium dense to dense. Only isolated pockets of material have the potential to liquefy during seismic loading with little or no impact on dam stability if left undisturbed during dam construction. Foundation materials under a portion of the Diversion Dam are loose to medium dense and could control the stability of the dam. The influence of the potential liquefaction zones was considered in the stability analyses for the Diversion Dam in Alternative 2 (Klohn Crippen 2005).

Liquefaction of the glaciolacustrine clay beneath the Main Dam foundation would be very unlikely due to the high fines content (*i.e.*, >30%). Large seismic events can be expected to generate elevated pore pressures in the clay and produce a short-term loss of strength following the seismic event (Klohn Crippen 2005). The location of a clay layer within the foundation beneath the right (south) abutment of the Starter Dam and its potentially low shear strength characteristics make the presence of the clay in the foundation a concern with respect to the design and stability of the tailings impoundment Main Dam. A portion of the clayey material would be excavated, stored within the disturbance area, most likely borrow areas, and backfilled with compacted fill to act as a "shear key" for stability (Figure 9). A shear key is an area excavated beneath the dam to enhance resistance against the dam sliding along a preferred plane or to increase shear resistance of material a circle failure plane would pass through and increase the FOS against slope failure. Based on preliminary design, up to three shear keys may be required under the final dam footprint. The extent of the glaciolacustrine clay and its strength would be assessed during final design to optimize the location and dimensions of the shear key to assure dam stability. Similar materials have not been identified in the foundation of the Poorman

tailings dam site, but geotechnical exploration is limited and would need to be expanded to confirm suitability of the dam foundation materials and stability of the dam.

**Table 77. MMC Design Criteria and Calculated Values for Factor of Safety for Alternatives 2 and 4 Impoundment.**

| Loading Condition | Standard | Minimum Allowable Design Value | Calculated Value |
|---|---|---|---|
| Static Loading Condition | Limit-Equilibrium Factor of Safety (FOS) | FOS = 1.5 For operations and closure.<br>FOS = 1.3 For end-of-construction conditions†. | 2.06<br>1.8 |
| Maximum Credible Earthquake (MCE) | Limit-Equilibrium FOS (Pseudo-static) | FOS = 1.15 For operating and end-of-construction conditions†. | 1.34<br>1.17 |
| | Displacements Estimated by Pseudo-Static Stability Analyses | Horizontal displacement of dam toe = 10 feet.<br>Vertical settlement at the ultimate dam crest limited to less than 3 feet to prevent release of tailings. | 2.5 to 10 feet<br>Not Available |
| Post-Earthquake | Limit Equilibrium Factor of Safety | FOS = 1.1 Using residual strength in liquefied tailings and glaciolacustrine clay. | 1.18 |
| | Dynamic Deformation Analysis | Assessment using Makdisi-Seed, and Hynes-Griffith and Franklin empirical methods, as cited in Klohn Crippen 2005. | 2 to 10 feet (horizontal) |

†End-of-construction stability generally refers to completion of a compacted earthfill dam, not a cycloned sand dam as construction would be ongoing. Values reported are for cyclone dam at end of 5 years of operation. End-of-construction FOS for the compacted starter dam and saddle dams are not available.
Source: Klohn Crippen 2005.

The MCE earthquake estimated for the project site probably would not cause the tailings to liquefy and result in a catastrophic failure. As discussed in section 3.8, *Geology*, the tailings at the proposed Montanore Mine are likely to be similar to the tailings at the Troy Mine. The tailings at Troy were found to be dilatant (Knight-Piesold and Co. 2007). A dilatant material (also termed shear thickening) is one in which viscosity (commonly perceived as "thickness," or resistance to flow) increases with the rate of shear.

MMC's design criteria (Table 77) set the level of design effort and target FOS values as a measure of safety. Operational performance and dam safety depend upon on the quality of the geotechnical data and the correct application and use of industry accepted design procedures to complete the design and estimate the FOS. For this reason, thorough geotechnical field explorations and complete laboratory test programs are essential in achieving a safe dam structure. The more reliable the available data, the fewer and less conservative are the assumptions for unavailable or unknown design information. Data that is less reliable or available

increase the assumptions and the conservatism required to achieve a safe design. Based on the data presented by Klohn Crippen (2005), it has been demonstrated that a safe tailings dam structure could be constructed for Alternatives 2 and 4 with respect to meeting the minimum allowable FOS design criteria. Critical conditions have been evaluated and conservative assumptions have been made regarding foundation conditions and strength parameters.

Based on the stability analyses and estimated FOS values for the tailings impoundment dam, the Main Dam would be stable and not exhibit signs of distress or failure. The analyses presented by Klohn Crippen (2005) adequately demonstrate the feasibility of constructing and operating a stable tailings dam under Alternative 2. Additional geotechnical exploration and laboratory tests would be needed to address assumptions made in the preliminary design and confirm the stability of the dam. In Alternative 4, the seismic design parameters would be re-evaluated using more current data and evaluation procedures and the dynamic stability confirmed based on any revised parameters. In addition, circular failure plane assessments through the near-dam tailings and dam section and through the dam crest and slope would be completed during final design of the dam.

Tailings slurry deposition patterns used in operations of the impoundment can influence tailings facility stability: the impoundment capacity, and tailings particle size segregation, which can influence the tailings consolidation characteristics. These two issues are not high risk items and normally not an influence in demonstrating the feasibility of a project. For the Little Cherry Creek site, the issues become important due to limited space for dam expansion beyond that proposed. In addition, changes in dam height and dam configuration to increase the impoundment capacity would be critical as it affects other design issues, such as the material mass balance for the cyclone sand dam. Dam stability could be affected, should additional dam height be required to store the tailings. The issue of tailings deposition patterns, and settled density would be re-evaluated during final design.

Perimeter discharge of tailings slurry, as planned by MMC, typically results in tailings surfaces sloped downward into the impoundment area. This downward slope of the tailings reduces the available capacity at a given height compared to capacity calculated assuming level tailings deposition. The current height-volume relationship for the Alternative 2 tailings impoundment site is based on level tailings deposition in the impoundment, with some freeboard allowance for the slope of the tailings surface (Klohn Crippen 2007). The agencies' analysis indicates that the height of the dam to achieve the excess capacity would need to be slightly higher than the estimated dam crest by Klohn Crippen to compensate for the lost volume based on the sloped tailings deposition and the final tailings surface configuration proposed by MMC. This in turn would require a modification to the dam design and a re-evaluation of the dam stability. Final determination of the dam height versus impoundment capacity would be based on tailings deposition plans and the proposed final end-of-operation surface grading plan. The final dam height and dam configuration would be detailed during final design to confirm the appropriate dam height for use in the final stability analyses.

Tailings deposition patterns into the impoundment also influence the dam height and ultimate stability should the average settled density be less than estimated. Larger particles settle nearest the discharge point and finer particles settle farther out as the slurry flows away from the deposition point. Long travel distances from the point of deposition often result in particle segregation within the tailings impoundment, which typically results in a tailings mass that exhibits lower average settled densities and consolidation characteristics different from the tailings tested in the laboratory. Densities lower than estimated may require additional dam height

to provide the same storage capacity. Lower tailings densities may also impact the dam stability analyses when considering stability of the upstream section of the dam crest.

In the 1992 Montanore Project Final EIS, the issue of artesian ground water conditions beneath the Little Cherry Creek impoundment site was discussed. Artesian pressures at both impoundment sites (Little Cherry Creek and Poorman) were identified in some boreholes during the site investigations conducted by Noranda (Morrison-Knudsen Engineers, Inc. 1990). Noranda proposed to use a system of pressure relief wells to relieve artesian water pressures. In 1992, the agencies concluded an adequately designed pressure relief well system would relieve artesian pressure and ensure dam stability during all project phases. The agencies indicated a more conservative approach was needed during the initial construction and operation phase than that proposed in Noranda's conceptual design (USDA Forest Service *et al.* 1992).

MMC reviewed the hydrogeology and assessed the potential effects of the artesian pressures on the dam stability (Klohn Crippen Berger Ltd. 2008), and concluded:

- The stability of the downstream slope of the dam is controlled primarily by the soft glaciolacustrine clay, and the strength of the clay is controlled by the undrained shear strength
- The proposed downstream slope of the dam is flatter than the original design by Morrison-Knudsen
- The impoundment design includes an extensive underdrain system, which would limit the transfer of hydraulic head from the impoundment into the foundation soils
- Existing artesian pressures are not expected to become significantly higher due to impoundment construction and the artesian pressures would not affect the failure mode, including a failure plane through the glaciolacustrine clay
- The dam would be raised in stages over the life of the mine and piezometric pressures in the foundation would be monitored

The agencies concurred with MMC's conclusions regarding artesian pressures based on available data. The foundation design would be confirmed as part of the final design studies.

**Failure Mode Effects Analysis**

In addition to completing stability analyses to verify that the design criteria FOS would be met for the tailings dam, MMC completed a qualitative risk assessment using a modified Failure Mode and Effects Analysis (FMEA) process (Klohn Crippen 2005). The FMEA is an engineering reliability technique used to systematically identify, characterize, and screen risks that derive from the failure of an engineered system to operate or perform as intended. The term "risk" encompasses the concepts of both the likelihood of failure (the expected frequency of failure), and the severity of the expected consequences if such events occurred. FMEA seeks to characterize risks in a systematic way and is intended to identify the main risks or failure modes (McLeod and Plewes 1999). A FMEA reflects the information, judgment, and professional opinion available at the time it was performed (USDA Forest Service and DEQ 2001). Because predictive risk assessment involves foreseeing the future, it is an imprecise art (Robertson and Shaw 2003).

An assessment of likelihood and consequences of failure for construction, operations, and closure was made for each of the design and operational components. Three issues were included in the

FMEA related to the tailings dam stability: 1) increased pore pressure in glaciolacustrine clays resulting in lower FOS against dam/foundation failure; 2) unidentified liquefiable glacial outwash material in the dam foundation leading to reduced dynamic and post-earthquake FOS estimates; and 3) impoundment underdrains and/or the drains in the base of the cyclone sand dam became plugged and did not function on closure (Klohn Crippen 2005).

The FMEA was completed in a sequential manner by identifying the following:

1. Likelihood of failure quantified on a five-level scale based on an annual probability of failure/percent chance of occurrence (>50%, 10-50%, 1-10%, 0.1-1%, and <0.1%)
2. Consequences of failure ranked on a five-level scale (insignificant to catastrophic) for four areas (water quality, biophysical, community-social, and costs)
3. Level of confidence in the likelihood of failure and/or the consequences based on a three-level scale of high, moderate, and low
4. Compensating factors to reduce the risk for each failure mode and effect

The factors were compared and a Level of Risk was determined for each item. The Level of Risk ranged from Level 1 (completely unacceptable) to Level 5 (lowest level of risk). Each Level of Risk was identified by a pairing of likelihood of an occurrence with consequences of the occurrence. As the Level of Risk decreased, the possibility of occurrence/outcome pairings that resulted in that Level of Risk increased, as summarized below.

- Level 1 – A likelihood of "always certain" and "catastrophic" consequences
- Level 2 – Likely occurrence and catastrophic consequences to certain occurrence and major consequences
- Level 3 – Possible occurrence and catastrophic consequences to always certain likelihood and moderate consequences
- Level 4 – Unlikely occurrence and catastrophic consequences to always certain likelihood and minor consequences
- Level 5 – Conceivable but improbable occurrence and catastrophic consequences always certain occurrence and insignificant consequences

Of the 27 failure modes evaluated, six were judged to have a risk level of 4. The 21 other failure modes had risks levels of 5 or greater. One failure mode, loose glacial outwash material liquefied under seismic loading, leading to a reduction in factors of safety and dam failure, had an unlikely likelihood of occurrence, and catastrophic consequences (such material was not encountered or indicated as potentially present in the site in the existing site investigation data). The other five modes had greater likelihood of occurrence, but a minor to moderate consequences. Compensating factors for all failures modes for Alternative 2 are described in Klohn Crippen (2005).

#### *3.9.3.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative*

The lead agencies completed a stability evaluation of Alternative 3. The purpose was to confirm the feasibility to locate and design a stable Poorman Tailings Impoundment facility at a 120 million-ton capacity between Little Cherry and Poorman creeks.

Design criteria for minimum FOS values for static and dynamic loading conditions were the same as set for the Alternative 2 impoundment site. The PGA value for use in the pseudo-static analysis was assumed to be the same as Alternative 2. The two sites (Alternatives 2 and 3) are adjacent to one another and have similar foundation conditions. In addition, Alternative 3 borrow soils and cyclone sand foundation materials were assumed to be similar to the Alternative 2 materials; therefore, the Alternative 2 strength parameters were used in the stability analysis. In some cases, lower values were used in the analysis as a degree of conservatism because site-specific data for Alternative 3 are limited and Alternative 3 would be a critical facility to the project. The strength parameters for the tailings were slightly increased to a friction (phi) value equal to 20° because Alternative 3 tailings would be deposited as a high-density slurry resulting in a denser in-place product. Tailings placed as a high-density slurry generally show an increase in shear parameters over tailings placed at a lower slurry density (Klohn Crippen 2005).

The stability of the Alternative 3 tailings dam was evaluated using the slope stability computer program STABL developed at Purdue University. The use of the STABL program is widely accepted in the dam design/geotechnical industry as a suitable design tool, as is the program used by Klohn Crippen for the Alternative 2 stability analysis. Both programs incorporate the same methods of analyses in estimating the FOS of a slope. Several commercial software programs that incorporate the STABL program are available. The commercially available software XSTABL 5.0 was used to facilitate data input and view plots of the most critical surfaces (lowest FOS) determined in the analyses. Potential failure surfaces were searched for through-dam sections and tailings impoundment section and through the crest and near-dam tailings. In addition, the stability of the tailings slope deposited from the back of the impoundment and above the dam crest elevation was checked to assess the feasibility of placing the tailings in such a configuration. Based on the results of the analyses, the Alternative 3 tailings facility can be designed as a safe and stable structure under both static and pseudo-static loading conditions. Table 78 presents a summary of the results.

**Table 78. Calculated Values for Factor of Safety for Alternative 3 Impoundment.**

| Case | Static FOS | Pseudo-Static FOS | Post-Earthquake FOS |
|---|---|---|---|
| *Average Strength Parameters* | | | |
| Cyclone Sand Dam<br>Minimum allowable FOS | 1.9<br>(1.5) | 1.4<br>(1.15) | 1.4<br>(1.1) |
| Upper Tailings Slope<br>Minimum allowable FOS | -<br>(1.5) | 1.8<br>(1.15) | 2.7<br>(1.1) |
| *Reduced Strength Parameters* | | | |
| Cyclone Sand Dam<br>Minimum allowable FOS | 1.5<br>(1.5) | 1.1<br>(1.15) | 1.3<br>(1.1) |
| Upper Tailings Slope<br>Minimum allowable FOS | 5.4<br>(1.5) | 1.5<br>(1.15) | 1.8<br>(1.1) |

Source: Glasgow Engineering 2008.

The tailings deposited from the back slope and above the dam crest elevation would create the most critical situation for instability in Alternative 3. This situation was evaluated in the stability analyses completed for Alternative 3 (Glasgow Engineering 2008). Based on the results of the

analyses presented in Table 78, the proposed cyclone dam and tailings slope would be stable under static and pseudo-static loading conditions and post-earthquake strength reductions. In all but one case, the minimum FOS was met or exceeded in the analyses. The one case that did not meet the minimum was the pseudo-static analysis of the cyclone sand dam assuming reduced shear strength values. The estimated FOS was greater than 1.0 (*i.e.*, not indicating a likely slope failure), but was lower than the minimum allowable FOS. Impacts of failure of the tailings slope would be similar to liquefaction of the tailings slope as noted in the following paragraph.

Liquefaction potential of the tailings slope was not considered in the stability review. Recently deposited tailings would be subject to liquefaction. The volume of the liquefied mass is critical only if the available storage volume within the impoundment at the dam crest elevation were less than the volume of tailings liquefied and if all of the liquefied tailings moved down into the impoundment area. This would not be a critical issue until near the end of the Year 16 of operations. At the end of Year 16, mud wave action from the liquefied tailings and displacement of water stored in the impoundment could result in the breach of the dam. This potential for release of tailings from the impoundment may be the most critical situation related to Alternative 3. Such a failure mode has not been quantified but should be included in the final design of the facility. The primary mitigation measure would be increased dam freeboard above the storage level of the tailings. This situation would be most critical in the later years of operation, as it is possible that tailings would not be stored very far above the dam crest until after Year 10 of operations.

The issues of discharge patterns and tailings consolidation patterns related to the dam stability are less influential than as described under Alternative 2. The anticipated slope of the thickened tailings was considered in the conceptual layout of Alternative 3. Also, thickened tailings would not "flow" out into the impoundment in the same manner as slurried tailings. In-place particle segregation and changes in consolidation characteristics are typically not as critical with tailings deposited as slurry.

A FMEA specific to Alternative 3 was not completed. Based on the similarities of Alternative 3 with the Alternative 2 tailings impoundment regarding site conditions and design, results of a FMEA for Alternative 2 would be similar to those identified for Alternative 2. The risks of Alternative 3 associated with the dam safety would be neither different nor greater than those summarized for Alternative 2. Exceptions would be analysis of the tailings liquefaction potential discussed above. Provided these issues are properly addressed in the characterization of the tailings impoundment/dam design and the impoundment operations manual, the tailings liquefaction potential and impact would likely be considered a Level 4 or 5 risk.

#### 3.9.3.3 Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison

This section presents a comparison of Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) tailings impoundment sites. The intent is to provide a summary of available data in each alternative in a comparative format. In general, the Poorman site was developed to avoid or minimize several environmental impacts of Alternative 2.

The primary technical difference in tailings disposal in Alternatives 2 and 3 is the method of tailings deposition used in each alternative. Alternative 2 is based on cyclone separation of the coarse fraction of the tailings for use in dam construction and typical slurry deposition of the finer fraction of the tailings into the impoundment area. Alternative 3 is based on cyclone separation of

the coarse fraction of the tailings for use in dam construction as in Alternative 2, and thickening the finer tailings slurry prior to deposition. The tailings would be thickened to increase the average in-place density of the tailings and reduce the required impoundment capacity.

The following sections present a comparison of the two alternatives based on data and information presented in Chapters 2 and 3, and MMC's Plan of Operations (MMI 2005a). The comparison is divided in technical issues identified during the analysis process of the two alternatives. The data for each issue are presented in a summary format with brief discussions provided only as needed to clarify the comparison.

#### *3.9.3.3.1 Site Capacity and Expansion Potential Tailings Deposition*

**Tailings Production**

- Alternative 2 – Primary and secondary cyclone for sand generation and use in dam construction; 55 percent slurry density deposited into impoundment from primary cyclone overflow. Direct deposition of secondary cyclone overflow into the impoundment. Tailings surface slope at 1 to 1.5 percent average.
- Alternative 3 – Primary and secondary cyclone for sand generation and use in dam construction; thicken slurry density of primary and secondary cyclone overflow to a 70 percent slurry density at deposition into impoundment. Tailings surface slope at 3 to 5 percent.

**120 million ton Capacity Requirement**

- Alternative 2 impoundment capacity is reported by MMC as 115 to 120 million tons for proposed tailings operations and a level tailings surface. Tailings discharge patterns into the impoundment have not been configured for sloped tailings and is subject to reduction of total capacity at the proposed dam crest elevation. The net capacity has not been confirmed at 120 million tons.
- Alternative 2 Tailings Deposition – Slurry tailings at 55 percent solids by weight with an average density at the end of operation of 75 pcf (pounds per cubic foot). Deposition of thickened tailings was not considered necessary unless final design studies showed higher density tailings were required to maintain the proposed dam and impoundment footprint.
- Alternative 3 capacity is 120 million tons for the proposed tailings operations and tailings deposition from a higher elevation along the back of the impoundment. Sloped surfaces and proposed closure surface used to confirm total site capacity. The impoundment site was evaluated for capacity assuming a level tailings surface. The site would require an additional 5 feet of dam height for thickened tailings deposition at 85 pcf (based on level tailings surface and not accounting for water management in the impoundment.
- Alternative 3 Tailings Deposition – Thickened tailings at 70 percent solids by weight with an average settled density of 85 pcf. Deposition of slurry tailings at 55 percent solids by weight was not considered practical for the total capacity as it would require an additional 15 feet of dam height. The ability to achieve these densities is discussed in the following *Operation Flexibility and Impoundment Expansion Potential* section.

**Dam Construction**

- Alternative 2 – Requires a Starter Dam, a North Saddle Dam, a ridge line South Saddle Dam later raised with cyclone sand, and a Main Dam constructed with cyclone sand (Figure 8).
- Alternative 3 – Requires a Starter Dam, a Rock Toe Berm to anchor toe area of main sand dam, an earthfill Saddle Dam, and a Main Dam constructed with cyclone sand (Figure 26).

**Foundation Conditions and Borrow Material**

- Alternative 2 – Foundation conditions generally good except that glaciolacustrine clay in Main Dam foundation potentially affects dam design. A portion of the clay would be excavated and backfilled with compacted fill to act as a shear key for stability. High ground water level in Main Dam area. Sufficient borrow materials available within facility footprint and adjacent areas. Granular materials available through commercial sources. The volume of cyclone sand available for dam construction per year based on yearly production rates versus required volume of sand to raise the dam annually to maintain adequate storage capacity in the impoundment area has not been generated to date by MMC.
- Alternative 3 – Foundation conditions generally good and similar to Alternative 2. Glaciolacustrine clay may not be present in foundation; additional geotechnical investigations would be required. High ground water level in Main Dam area. Sufficient borrow materials available within facility footprint and adjacent areas. Granular materials available through commercial sources. The volume of cyclone sand available for dam construction per year based on yearly production rates would meet required volume of sand to raise the dam annually to maintain adequate storage capacity in the impoundment area based on the proposed dam layout and impoundments operations. The annual dam volumes were interpolated from dam sections generated from raises at 40-foot height increments.

**Seepage Control**

- Alternative 2 – Seepage control in Alternative 2 would be provided primarily by collection drains in the impoundment and the dam foundation. The estimated seepage loss is 25 gpm into the foundation footprint. Additional design components to reduce seepage losses would include an increased density of the impoundment drainage system, a pumpback well system between the dam and Seepage Collection Pond, or a deeper cutoff trench below the starter dam and under the saddle dams. Seepage interception would be facilitated by the cross-valley dam design. Seepage interception would be more difficult south of the South Saddle Dam, which would be immediately adjacent to the Diversion Channel.
- Alternative 3 – Seepage control in Alternative 3 would be similar to the Alternative 2 design for seepage control. It is assumed that the average seepage loss would be about 25 gpm as in Alternative 2. The potential for additional seepage control is similar to Alternative 2 and would employ the same alternatives. Due to the wide footprint of the dam and the assumed underlying foundation geology, the occurrence of unacceptable foundation seepage below the dam would not likely be through isolated or confined zones in the foundation. The Poorman Impoundment Site would require a broader layout of the collection system. In addition, there would be less room downstream of the dam footprint to install a pumpback well system or other

seepage interception systems between the dam toe and private property not owned by MMC.

**Operation Flexibility and Impoundment Expansion Potential**

- Alternative 2 – Upsets in daily operations such as pump failures and surges in the tailings system could likely be handled or accommodated without problems or threat of breach due to excess water. An operating plan would address occurrences such as excess water build up or reduction in available cyclone sand. Generation of tailings slurry at 55 percent by weight is common. Less dense slurry deposition could occur due to improper design of the thickener or pumping system, temporary upsets in operations or improper operation practices. Such upsets are expected to be infrequent and short-term and should not affect the operation (water balance and storage capacity) of the impoundment. Expansion of impoundment capacity beyond the proposed layout would require modifications in the design and construction of the dam crest. The perimeter area for extending the toe of the dam and continuing raises per design to increase capacity is very limited beyond the proposed footprint. Potential alternatives for dam crest raises would include over-steepening the downstream slope in subsequent raises or designing a modified upstream raise of the crest.
- Alternative 3 – Upsets in the tailings thickeners and in daily operations would require an operating plan to accommodate short periods of conventional slurried tailings deposition within the site. Such occurrences could be handled and include short-term increases in water within the impoundment. The system required to thicken fine tailings to a slurry density of 75 percent has not been determined. The Montanore ore body consists of hard, unaltered rock that would be crushed to a fine-grained non-plastic material, which is generally amendable to thickening without the use of filters. The thickening system best suited for Montanore tailings would be determined before final design of the site was initiated. Once a system was determined feasible, the potential for upsets would be minimized and limited to infrequent and short-lived upsets as in Alternative 2. In the event it is demonstrated that the tailings could not be thickened in a reasonable manner, the suitability of Alternative 3 tailings facility would have to be re-evaluated and compared to Alternative 2. Expansion of impoundment capacity beyond the proposed layout would require modifications in the original design or in the design and construction of the dam crest some time after operations began. The perimeter area for extending the toe of the dam and continuing raises per design to increase capacity is limited beyond the proposed footprint. Potential alternatives for dam crest raises would include over-steepening the downstream slope in subsequent raises or designing a modified upstream raise of the crest. Depending upon the characteristics of the thickened tailings, upstream deposition patterns and discharge elevations could also be modified to increase storage capacity.

Based on these comparisons, both alternatives have equally positive as well as limiting attributes and characteristics. The single significant difference between the two alternatives appears to be the ability to deposit the finer fraction of the tailings as a slurry at 55 percent solids by weight in Alternative 2 versus the likely necessity for the deposition of the fine tailings as a thickened tailings at 75 percent solids by weight in Alternative 3. A secondary difference is that the storage capacity in Alternative 2 has not been confirmed relative to deposition patterns and the preferred tailings surface configuration at closure. The capacity in Alternative 3 was based on deposition

patterns and a final tailings surface configuration. Another secondary difference between the alternatives is the potential for additional seepage control once in operation. Alternative 2 site conditions are likely better suited for the installation of remedial facilities for seepage control and collection than in Alternative 3. Due to the deposition of thickened tailings in Alternative 3, there is less water available to contribute to or result in unacceptable seepage losses. Additional design studies are required for both alternatives prior to identifying a preferred alternative based on technical comparisons such as those presented above. The difference in expansion potential for the two sites is negligible, based on the available data and site layouts.

### 3.9.3.4 Cumulative Effects

None of the reasonably foreseeable future actions would result in cumulative effects of subsidence risk or impoundment stability with the Montanore Project.

### 3.9.3.5 Regulatory/Forest Plan Consistency

This section is not applicable to geotechnical engineering.

### 3.9.3.6 Irreversible and Irretrievable Commitments

This section is not applicable to geotechnical engineering.

### 3.9.3.7 Short-term Uses and Long-term Productivity

This section is not applicable to geotechnical engineering.

### 3.9.3.8 Unavoidable Adverse Environmental Effects

Some roof failure would occur in all action alternatives.

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